

NATURAL HISTORY

AUSTRALIA

THE LAND OF LIVING FOSSILS BY WILLIAM K. GREGORY—MAMMALIAN LIFE IN AUSTRALIA AND TASMANIA BY HARRY C. RAVEN—BIRD PERSONALITIES OF THE AUSTRALIAN BUSH BY R. T. LITTLEJOHNS—REPTILE LIFE BY CHARLES BARRETT—THE VANISHING WILD LIFE OF AUSTRALIA BY A. S. LE SOUËF—THE GREAT BARRIER REEF BY CHARLES HEDLEY

ROTORUA AND THE GEYSER REGION OF NEW ZEALAND—SOME PLAYS AND DANCES OF THE TAOS INDIANS—THE ELAND AND ITS BIRD SENTINEL—TURRET-BUILDING TERMITES—THE PUBLIC MUSEUM OF STATEN ISLAND—REVIEWS OF "BIRDS OF THE NEW YORK REGION" AND "IN BRIGHTEST AFRICA"

The American Museum is greatly indebted to the naturalists and officials of Australia for their coöperation in assembling materials representative of their great continent

JOURNAL OF THE AMERICAN
MUSEUM OF NATURAL HISTORY
EXPLORATION·RESEARCH·EDUCATION

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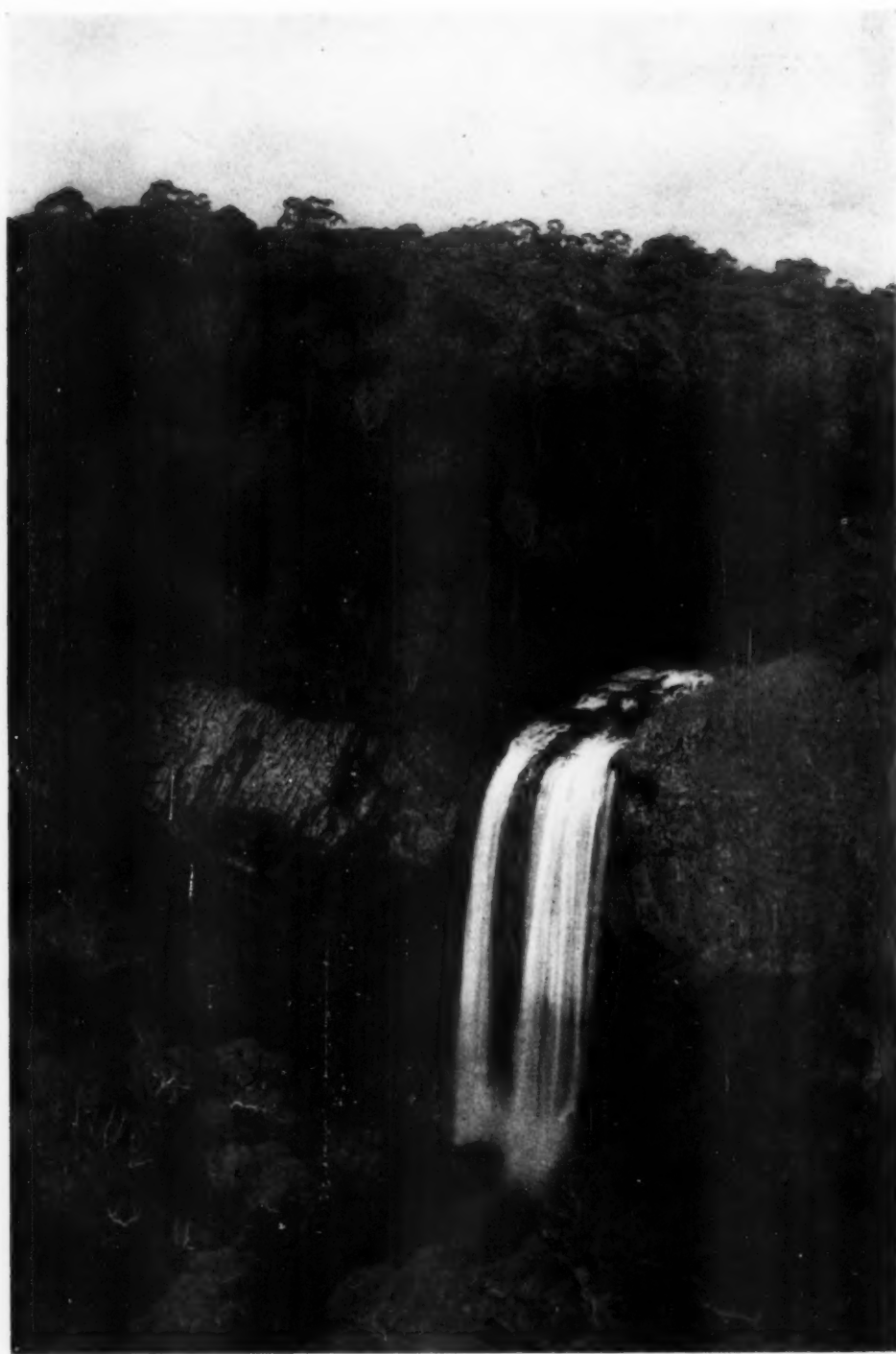
NATURAL HISTORY for March-April, 1924, will be made up to a large extent of articles dealing with the American Museum's work in **ASIA**, a continent that has been looked upon by many as the probable cradle of the human race and which investigations tend to show was also the center of distribution from which many forms of animal life spread westward into Europe and eastward into North America.

Mongolia, until recently assumed to be devoid of fossils, has proved, as a result of the work of the Third Asiatic Expedition, to be one of the richest depositories of the zoological records of the past. The recovery from this region during the last year of no less than seventy skulls and ten skeletons of primitive horned Ceratopsian dinosaurs and contemporary carnivorous dinosaurs, as well as three nests and twenty-five dinosaur eggs—the first ever unearthed—is proof of the vast legacy of information that the past has bequeathed to the present, conserved in the Mongolian sands. The discoveries of the Third Asiatic Expedition in this area will be featured, according to present expectations, in the March-April issue by contributions from Professor Osborn, Mr. Roy Chapman Andrews, and Prof. Charles Berkey.

The Faunthorpe-Vernay Indian Expedition, which has already yielded the American Museum a representation of the big-game animals of India that it would be exceedingly difficult to duplicate, has been conducted with a sumptuousness that dazzles the imagination, and the dramatic incidents connected with it, as related by those who gave their time, their experience, and their funds to assure its success, will prove fascinating reading.

Another Museum undertaking that is yielding astonishing results is the fossil-gathering expedition to the Siwalik Hills of India under the leadership of Mr. Barnum Brown. On the basis of the specimens that have reached the Museum an article is being prepared by Curator William D. Matthew, indicating the importance and interest of the finds.

Other articles that deserve more than passing notice are the account prepared by Mrs. Walter Granger, of her journey up the bandit-infested Yangtze and a narrative of hunting in Kamchatka, the home of the black bear, recounted by Dr. Waldemar Jochelson.



Photograph by Harry C. Raven

THE FALLS OF THE GUY FAWKES RIVER AT EBOR

This inspiring scene will be the setting for a group of flying phalangers, planned as a part of the Australian exhibition in the American Museum

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Australia, the Land of Living Fossils

AS EXEMPLIFIED IN THE PROPOSED AUSTRALIAN EXHIBITION,
AMERICAN MUSEUM

By WILLIAM K. GREGORY

Curator of Comparative Anatomy, American Museum

DIRECTOR Lucas once said that his favorite occupation in heaven would be the planning and arranging of a museum in which each of the great continents would be represented by a single large hall containing exhibits illustrating the physical geography, geologic structure, the animal and plant life, and the human inhabitants of that continent. But if the plans now being engineered by President Osborn go through, as his other plans have, Director Lucas may have the opportunity of fulfilling his aspiration in this world.

The return of Mr. H. C. Raven from Australia with his priceless collections intact brings us one step nearer the acquisition of a hall devoted exclusively to that island-continent. Ordinarily it is better in an article of this kind to write about what has been done rather than about what is hoped for, but in this case a preliminary indication of the plans may possibly help a little toward their realization.

In brief, our object is to give the visitor a vivid impression of the more salient features of Australia rather than to overwhelm him with the vast deposit of details that conceals Australia in encyclopædias. We want him to view, as if he had been there, some of the more characteristic scenes.

The centerpiece of the mammal exhibit will be the Kangaroo Group. The background will be the Australian

"bush" (or open forest) of eucalypt trees, with the sunlight streaming through the thin foliage. In the foreground a dingo, or wild dog, has just bounded into view and is hurling himself at the nearest kangaroo, an old male. Two of the females, one of them with a large young one in her pouch, are leaping frantically in different directions. A little way back, still another kangaroo is raising its head in a startled way, and in the distance a few are feeding quietly.

As most of the Australian mammals are nocturnal in habit, it is the plan to have a moonlight scene with the beautiful gorge and falls of the Guy Fawkes River in the background. Standing in front of this exhibit, the observer will imagine himself near the brink of the gorge with his eye on a level with the upper parts of some of the trees that are down the slope. Dimly seen in the moonlight are several flying phalangers, which are hitching themselves up the branches in their characteristic way. One of them has just started on a long skimming flight, his arms and legs outstretched and the skimming membrane held taut as he swoops downward toward a near-by tree.

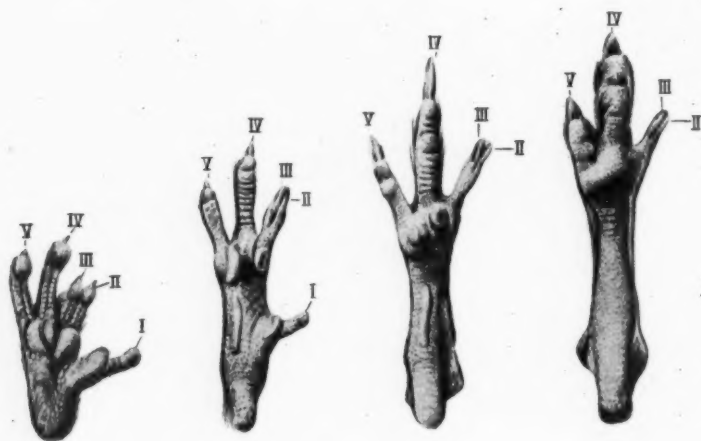
Other groups will show the interesting tunnels and underground chambers of the duck-billed *Platypus*, as well as its nest with the eggs that this most reptilian of mammals lays. In other groups the visitor will see the wombats, the native "bears," the tree kangaroos,

and some of the other marsupial oddities for which Australia is justly famous.

Nor will the needs of the more serious student be neglected. The Australian marsupials have a very high scientific prestige on account of the exceptionally clear evidence they afford concerning the evolutionary history of the group, and in these times they would doubtless have a considerable public interest if this fact were more widely recognized. It so happens that in that out-of-the-way corner of the world the marsupials have been shut off and protected for long ages from the overwhelming competition of the higher, or placental, mammals. Under these conditions the struggle for life within the continent has not been very bitter until relatively recent times nor has extinction been on such a vast scale as in other parts of the world. There is much evidence to show that evolution has always proceeded at unequal rates in different members of a natural group, some out-distancing others in the development of particular structures. Wherever

wholesale extinction has been arrested, we should and do find many stages in the development of a particular structure. In Australia competition has doubtless eliminated many forms but we still have a surprising number of intergrading conditions.

This fact can readily be demonstrated in the Australian hall in several ways. There will be presented, for instance, a series of large models of the feet of various marsupials. The visitor will be able to see at a glance how, for example, the five-toed foot of the phalangers, although already highly adapted for climbing, leads into the elongate hopping foot of the wallabies and kangaroos. He will see how gradually the grasping great toe diminishes and finally disappears, and how at the same time the fourth toe becomes greatly elongated. He will see how even in the most advanced types of kangaroos the two little toes, the second and third of the ancestral foot, still persist, although their long bones are reduced to mere threads. Why, the



After Bensley

The gradations between the five-toed foot of the phalangers (left), adapted for climbing, and the elongated foot of the wallabies and kangaroos (right), specialized for hopping, will be shown in the Australian exhibition



A skeleton of the giant extinct marsupial *Diprotodon*, mounted in the American Museum from replicas of the original bones of this animal supplied by the South Australian Museum at Adelaide



A provisional restoration of *Diprotodon* by E. Rungius Fulda. The body of *Diprotodon* was like that of a wombat but vastly larger



From a sketch by E. Rungius Fulda

AN ARKÆOLOGICAL EPIC

Father Noah and his sons, they invited to the Ark
 A distinguished group of mammals, all placental,
 But they snubbed the duck-billed platypus and jumping kangaroo
 In a manner that was very far from gentle.

To the Talgai boy they hinted he was nothing but a moron
 Whom principles eugenic would condemn,
 That they'd better let him perish than continue as a menace
 To society, and Japheth, Ham, and Shem.

So he called the big *Diprotodon* and on his back he climbed,
 And he whistled to the friendly dingo, too;
 The platypus and wombat and the rest fell in behind,
 As frequently the simple-minded do.

They jumped upon an island that kindly floated by
 And they drifted far to southern seas unknown,
 Where these brave Marsupialia in a land we call Australia
 Formed a doughty little kingdom of their own.

Now the scientists pedantic who defend the bridge Atlantic,
 When they hear this tale authentic I'd advise
 To apologize quite meekly to these creatures who uniquely
 Controverted an hypothesis so wise.

E. H. FINK

visitor may well ask, does the foot of the kangaroo retain these vanishing side toes? Is it merely to baffle the curious, or is it not because nature everywhere leaves her imprints or true vestiges by which comparative anatomists and palæontologists are slowly but surely deciphering the record of life?

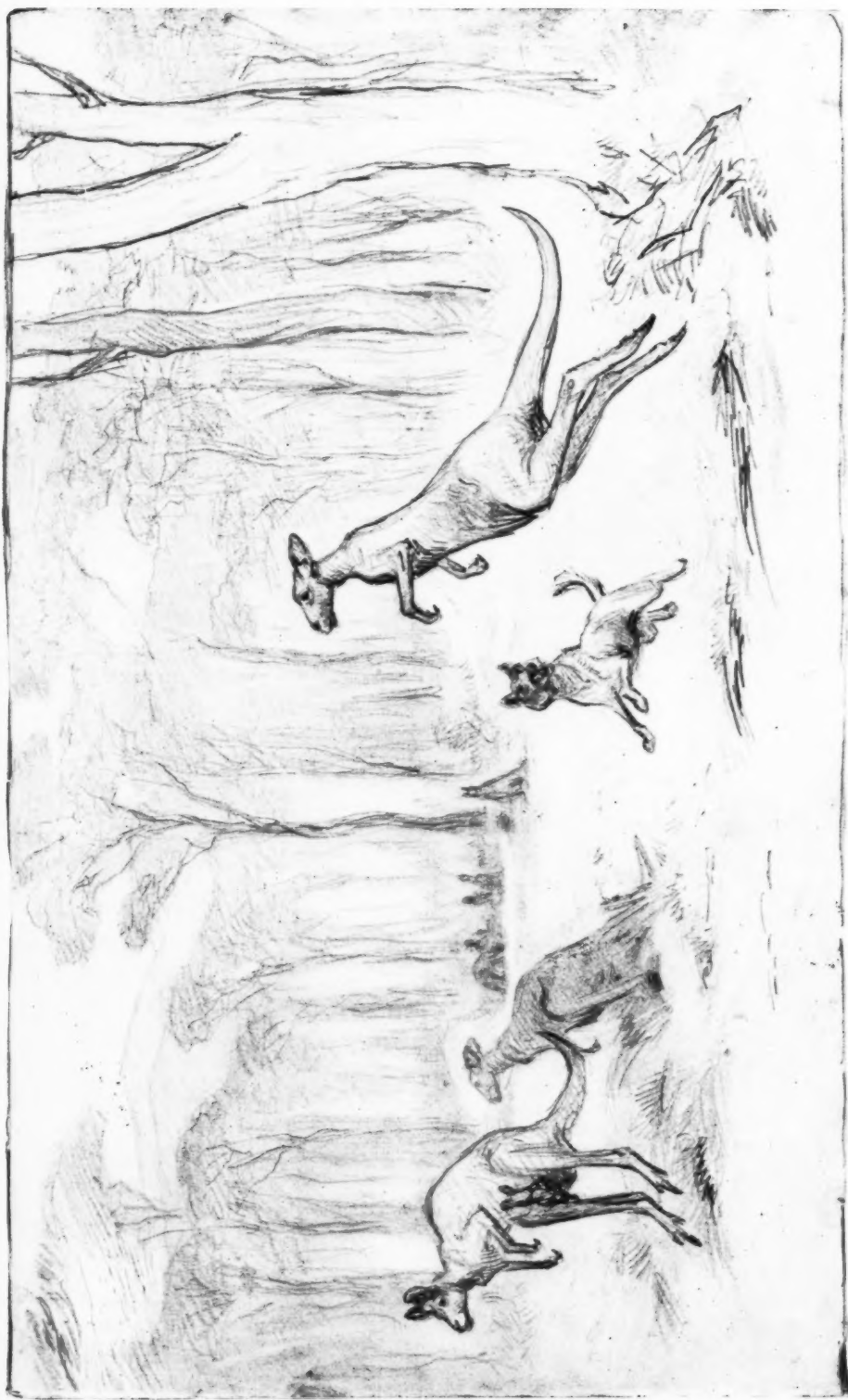
The visitor who will take the trouble to examine the next exhibit planned will see that although nature has fashioned the marsupials into many different forms, adapted for running, leaping, climbing, skimming, digging, etc., she has nevertheless built all these diverse forms around a common structural plan. He will see that marsupials are born in a relatively early stage of development and that they are fastened to the teats in the mother's pouch. He will see that notwithstanding the great differences in the general form of the skulls and in the dental apparatus of the grass-eating, carnivorous, leaf-eating, and gnawing marsupials, all these skull forms show many curious and striking details in common, which in the judgment of all modern students of the group have been inherited from a remote common ancestor that lived before the diverse modern lines had become differentiated.

Zoölogical science has long since sketched with considerable confidence the chief characteristics of this remote common stock of the marsupials. Huxley predicted that the common ancestors of all the existing Australian marsupials would be found to be remarkably like the existing opossums of North America; and this judgment has been confirmed and amplified by the brilliant investigations of Dollo and of Bensley. But it is only of late years that palæontologists have found true American opossums, or very close relatives of them, in association with the

remains of the gigantic dinosaurs of the Upper Cretaceous in western North America. These, together with remains of related animals found in South America and in Europe, indicate that at some period, probably late in the Age of Reptiles, the opossum tribe had an almost world-wide distribution.

When Australia was cut off from the rest of the world, probably through the sinking and fragmentation of the southeastern extension of the Asiatic land mass, primitive opossum-like marsupials, together with the ancestors of the still lowlier duckbill and spiny anteater, were the only types of mammals in that part of the world. There they found themselves in forests of eucalypts, ancestral to the gum trees of today and closely related to trees and shrubs that have been found as fossils in the Upper Cretaceous of North America. Here in the old Australian land mass the primitive opossums were safe for many hundreds of thousands of years from the competition of the newer, or placental, mammals which were developing in the Northern Hemisphere. But under the stress of competition with each other the primitive marsupials began that great deployment, or adaptive radiation, which finally resulted not only in the highly diversified marsupials of today but also in the many strange and gigantic types that flourished in the broad Australian plains of Pleistocene times, when the northern world was passing through a succession of alternating glacial and interglacial periods.

Among the most interesting of the giant extinct marsupials were the *Diprotodon* and allied genera. Replicas of the original bones of *Diprotodon* have been sent to the American Museum by the South Australian Museum at Adelaide, and after careful



THE ATTACK OF THE DINGO

On the basis of this sketch by Charles R. Knight will be constructed the Kangaroo Group, the centerpiece of the Australian mammal exhibition. The wild dog of Australia is one of the chief enemies of the marsupials, being outrivaled as an agent of destruction only by man himself

study the skeleton was mounted as shown in the picture on page 7. This was the first specimen to be prepared for the Australian exhibit; it is temporarily placed in the hall of the Age of Man, since it was probably a contemporary of the oldest races of men. The *Diprotodon* has been called the marsupial elephant, because its molar teeth somewhat resemble those of the mastodon. But on the whole the *Diprotodon* more nearly resembles a giant wombat, with molar teeth more like those of a kangaroo.

By means of colored maps and relief models the visitor will be able to see graphically that even at the present time Australia is connected by shallow water with New Guinea on the north and with Tasmania on the south. The very close relationships of the animals of North Queensland to those of New Guinea leaves no doubt regarding a former connection of these lands. The connection with Tasmania is indicated not only by such strong faunal evidence as the occurrence of closely allied species of the huge herbivorous marsupial *Nototherium* and of wombats on opposite sides of Bass Strait, but also by the plain geological evidence indicating recent submergence of the land beneath the strait.

The descendants of the old settlers, the marsupials, did not forever remain in undisturbed possession of the land of their fathers. Australia today has adopted the slogan "Keep out the Asiatics," but in the distant past the "Asiatics" in the form of various placental mammals somehow got in. First came the rats, ages before man. When the rats began to branch out, some of them became water rats (*Hydromys*), some (*Conilurus*) became hopping forms like certain of their marsupial rivals, while others com-

peted with each other in field and underbrush, so that today we find five genera and about twenty species of rats and mice peculiar to Australia. A little later perhaps came the bats; and finally the dingo—a wild dog, remains of which have been found fossilized in New South Wales. All of these placental mammals competed with, or waged war upon, the old marsupials. But the latter were never seriously depleted, not even with the coming of the ancestors of the Australian aboriginals, who, as we know from the Talgai skull and other evidence, have been in Australia for thousands of years. Finally, late in the eighteenth century, there arrived in Australia by far the most destructive placental mammal the world has ever seen, namely, *Homo sapiens*, variety *europæus*, who has devastated the continent and is now completing the work of destruction.

The significance of the Australian mammal fauna, our intelligent and, we hope, still interested visitor, will readily comprehend from the exhibits that we shall gladly prepare for him. But he will by this time doubtless be willing to turn to some of the more spectacular scenes that we are holding in reserve. We shall show him the beautiful lyre bird, the amazing constructions of the famed bower bird, the great mounds heaped up by the lowans, the "Mound Builders" of the bird world, for the incubation of their eggs. Nor shall we omit the ostrich-like emu of the plains. If possible, we shall place at the visitor's disposal a phonographic record of the "song" of the astonishing kookaburra, or laughing jackass. It will be an infallible test. If the visitor is a child, he will want to hear that "song" (?) again and again. If he is a normal adult, a single performance may suffice.



After Dumont d'Urville

AUSTRALIAN NATIVES PERFORMING THE DINGO DANCE



THE KANGAROO DANCE, ANOTHER ACT IN THE SERIES OF CEREMONIES INTRODUCED BY THE DINGO DANCE

After Dumont d'Urville



Courtesy of Mr. J. W. Beatty

The Tasmanians, who nearly a half century ago died out as a people, represent a type far down in the scale of human evolution. The last survivors were wards of the government

There are many curious and even terrible reptiles in Australia, which will by no means be neglected in our future Australian hall.

We hope to show our visitors something of the life of the Australian and Tasmanian aborigines. In the case of the latter not much can be done, for the simple reason that the last of the Tasmanians died in 1876 at a time when the museums of the world had secured extremely little material illustrating the appearance, habits, and bodily structure of what was undoubtedly one

of the most primitive of all recent races of mankind. The last few survivors of the race, after a long and bitter warfare with the white settlers, were induced to surrender themselves to the care of the government and lived for many years in a small settlement. Fortunately a few enlightened individuals seem to have realized the extraordinary human and scientific interest of these people and took a number of photographs of them, which in our time have been carefully brought together and preserved by Mr. J. W.



Courtesy of Mr. J. W. Beatty

Front and side views of Truganini, the last of her race, who died in 1876

Beatty of Hobart, Tasmania. Mr. Beatty kindly supplied the American Museum with an excellent set of prints from the original negatives and it is the intention to exhibit these pictures in the Australian hall, together with several death masks and some of the very primitive stone implements that the Tasmanians were still using when the island was settled by the white colonists. The photographs here reproduced of Truganini, the last survivor of the race, and of some of the companions of her later days, show very well the racial traits of the Tasmanians. They differed from the aboriginal Australians in having short and woolly hair instead of long and wavy hair; their noses were excessively wide and somewhat gorilloid in appearance, and there is also something ape-like in their very wide mouths and retreating chins. They were allied in cranial and facial characters to the Papuans and Negritos. There is some evidence for the view that they preceded the Australians on

the island-continent and were driven south, before the sinking of Bass Strait, by the Australians coming from the north.

The life of the Australian aborigines will be represented by several mounted groups. A model of a man about to throw a boomerang at a fleeing wallaby seems a prime necessity, while if the material can be secured we should like to illustrate some of the curious customs of the natives, such as the kangaroo dance or the dingo dance or one of the elaborate initiation ceremonies.

Finally we hope to give our visitors some idea of the vital and stimulating Australia of today, so that he may realize that another America or, more precisely, another Canada, is being built by the Anglo-Saxon stock upon an ancient platform of the world.

In striving for the realization of these plans we confidently count upon the continued generous coöperation of our many friends and colleagues in Australian museums and universities.



A view from Point Lookout, northern New South Wales, on the upper edge of the escarpment and about forty miles from the Pacific, which lies beyond the farthest mountains visible in the picture

Glimpses of Mammalian Life in Australia and Tasmania

AN ACCOUNT OF PART OF THE WORK CARRIED ON BY THE FIRST AUSTRALIAN EXPEDITION OF THE AMERICAN MUSEUM¹

By HARRY C. RAVEN²

Field Representative of the American Museum in Australia

AFTER a railway journey from Sydney northward along the coast, then inland to the top of the escarpment and along the great plateau to Armidale, followed by a fifty-mile ride, partly by motor car and partly by cart, over muddy roads, a wait of several days for floods to subside, and then a resumption of the journey for a few additional miles through forest and across streams, Doctor Gregory and I reached the site of our first camp in the open eucalyptus forest of northern New South Wales. It was July, the coldest month of the Australian winter, and we were in what is one of the coldest parts of the continent, due to the elevation of slightly more than 5000 feet. Nevertheless, the utter barrenness of a northern winter was lacking. The monotonous gray-green of the eucalypts could be seen in every direction. Their rather scant foliage, added to the fact that the trees as a rule grow several yards apart, allowed an abundance of sunlight to stream through the

¹Although the author visited many types of country in Australia, from the humid tropical jungles of North Queensland to the almost Alpine woodlands, bogs, and rugged hills of Tasmania, in the present article only the coastal belt of the eastern part of the continent and western Tasmania are considered, and not the great arid plateau of the interior of Australia, where mammals are relatively scarce. The account is also limited to four of the types of country visited, with the native mammals found in these various habitats.

²The photographs accompanying this article were taken by the author.



Flood of the Guy Fawkes River in northern New South Wales.—Though this region, where the expedition began its work, is not one of exceptionally heavy rainfall, winter floods are common and rivers rise suddenly, inundate fields, wash away bridges, and frequently make travel impossible



An open eucalyptus forest in northern New South Wales, haunt of the flying phalanger and the great gray kangaroo. Much of the country has been cleared by ring-barking the trees



The flying phalanger (*Petauroides volans*) is a beautiful animal that inhabits the open eucalyptus forest, hiding in hollow trees during the day, feeding on eucalyptus leaves by night



The pygmy flying phalanger (*Acrobates pygmaeus*) of northern New South Wales is a tiny relative of *Petauroides volans*. It is about as small as a mouse while the larger phalanger is comparable in size to a cat. Both of these animals were found in the first type of country visited

branches striking the light-colored trunks and the pale, bleached dead grass beneath.

It was here that we first saw the great gray kangaroo (*Macropus giganteus*). When sighted, the animals were close to the ground, on all fours, quietly feeding. A moment later, aware of our presence, they sat upright looking in our direction; then suddenly turning, made off, leaping with amazing speed and grace, their small fore limbs pressed close to the body, their great hind legs working in unison like gigantic springs to throw the body forward. An adult female kangaroo was secured, with a tiny young one in the pouch.

The clearing of the forests by the settlers produces a better crop of grass and the kangaroos and wallabies are quick to take advantage of this improved food supply. Favored by such conditions, they multiply greatly, only to be persecuted by the settlers, who

want to stock the land with cattle or sheep to its fullest capacity. Thus the native wild animals are driven back into unsettled country, rocky hills and ravines, or sometimes completely exterminated. The principal factors in the destruction of the kangaroos and wallabies over thousands of square miles of territory are, in the order of their importance: man, the dingo, the fox, and the cat, while to these aggressive agents must be added the pacific competition of the rabbit, which, itself a grass-feeder, limits the available pasturage by its incessant nibbling. There are, however, still extensive areas of uncleared land in the coastal belt where the marsupials take refuge.

The flying phalanger (*Petauroides volans*), like our flying squirrel, lives in trees, and in the moonlight may be seen making long gliding leaps from tree to tree. This animal is about the size of a cat but extremely slender.



The common "opossum" (*Trichosurus vulpecula*), which in many localities of New South Wales has been almost entirely exterminated, is still common in parts of Queensland



A TREE KANGAROO

The foot of *Dendrolagus lumholtzi* is broad and especially adapted for climbing in contrast to the elongated foot of the jumping kangaroos

Possibly it has developed its gliding habit to avoid the peril of a slow trip along the ground to the next tree. Fortunately, its skin is of little value commercially. For this reason it is not persecuted while its relative, the common vulpine phalanger or "opossum" (*Trichosurus vulpecula*), has fallen in millions to the fur hunter and has disappeared from many localities. The pygmy flying phalanger (*Acrobates pygmaeus*) is a little animal, the body of which is about three inches long. It makes its nest in the "spout" of a tall gum tree and is very difficult to find. These flying phalangers, with the "opossum" (*Trichosurus*), the native "bear" (*Phascogale*), and the tree kangaroo (*Dendrolagus lumholtzi*), present peculiar adaptations of the marsupial type for life in the trees.

The second type of country that I visited (Doctor Gregory had returned to the United States to resume his duties in the American Museum) was the tropical rain forest of North Queensland. These tropical "scrubs," as they are called, are humid, dark jungles—the haunt of the cassowary, the bird of paradise, and the tree kangaroo. Here there are no eucalypts but many huge tropical trees take their place, trees that are very valuable for their timber. From their branches hang long lianas and rattans. There is a great profusion of ferns and epiphytic plants, all rich green in color, usually dripping with moisture, looking fresh and clean from nightly baths of heavy dew and frequent tropical showers. The flora of the rain forest suggests relationship with that of the tropical islands of the north, New Guinea, Celebes, and others.

The tree kangaroo, one of the most curious of all marsupials, was found in this rain forest. It is nocturnal in

its habits, sitting quietly by day on the branch of a large tree, usually where it is protected from the sight of its enemies by gnarled lianas, orchids, and leaves. When night comes on, it descends the tree trunk, tail first, to hop along the ground among the thick underbrush, the leaves of which comprise most of its food. If alarmed or otherwise disturbed on the ground at night, it immediately takes to the trees. On the other hand, when the Australian blackfellow climbs up the tree after it, it will sometimes jump down to seek safety on the ground, leaping from a height of thirty feet or more.

Another denizen of the tropical rain forest is a little animal not as large as a rabbit, called the musk kangaroo (*Hypsiprymnodon moschatus*). To the evolutionist it is the most interesting of all the kangaroos, because of the characters that establish its place as a connecting link between the family of phalangers and the more specialized kangaroos.

The third type of country in which collections were made was the cleared alluvial plain, resulting from the destruction of the tropical rain forest, for the cultivation of sugar cane and other crops, principally the former. The country best suited for cane-growing in the Cairns district to which I refer, is the alluvial plain at the base of the mountains. Here there is a great depth of soil in a region of very heavy rainfall—more than one hundred inches a year. The cane fields have become the favorite haunt of bandicoots (*Perameles*), which are peculiar, long-nosed, pouched animals about the size of a rabbit. They make their nests among the cane and feed upon the larvæ of beetles which they find about the roots of the plants. The cane growers consider the bandicoots an asset, for the

grubs they eat are said to be destructive to the cane. Prior to cutting the cane, it was the practice of the cutters to burn off the leaves. When this was done, all the animals that secluded themselves in the cane fields were obliged to flee if they wanted to avoid being roasted. By waiting on the outskirts of the field at such times it was possible to gather in many a fine specimen. Of course, with the destruction of the original forest, all the arboreal forms, such as phalangers and the tree kangaroo, were driven away; only those animals that adapted themselves to the changed conditions are today found in this new environment.

The fourth variety of country which I explored was that of western Tasmania, where I spent more than four months. It is a region of exceptionally

heavy rainfall—from fifty to one hundred inches a year—though the area of the heaviest fall is comparatively small. The suddenness, frequency, and severity of the storms were always a source of surprise. The great eucalypts would sway back and forth as the wind that accompanied the rain or sleet swept howling through the branches, which towered in some cases more than two hundred feet above our tent. The forest was not composed entirely of eucalypts or of evergreen myrtles, which are really beeches (*Fagus*). In most cases the low hills and better drained slopes were forested with the pale-colored giant gums, beneath which were thickets composed of shrubs of several varieties, bracken, and acacias. On the flats, where the soil was deep and very rich, were growing evergreen



A Tasmanian forest of beech, or evergreen myrtle, with undergrowth of tree ferns. It is in country like this that the Tasmanian "devil" is at home

myrtles, with their straight trunks and small leaves of much darker tone than those of the gums and acacias. Beneath the myrtles were a dense undergrowth and many palmlike tree ferns with their thick trunks dripping moisture. Then there would be flats where there was no forest—just a boggy plain with bunches of button grass (*Meso-*

melæna sphærocephala) and innumerable small plants with pink, white, and yellow flowers.

These plains are the favorite haunt of the wombat, which digs its deep burrows near the edge of the plain and feeds at night on the vegetation. Here, too, is the haunt of the thylacine (*Thylacynus cynocephalus*), the largest



A Tasmanian forest of eucalypts, principally stringy-barks (*Eucalyptus obliqua*) and peppermint gums (*E. amygdalina*). The banks of the streams in Tasmania are frequently overgrown with wattles (*Acacia*)



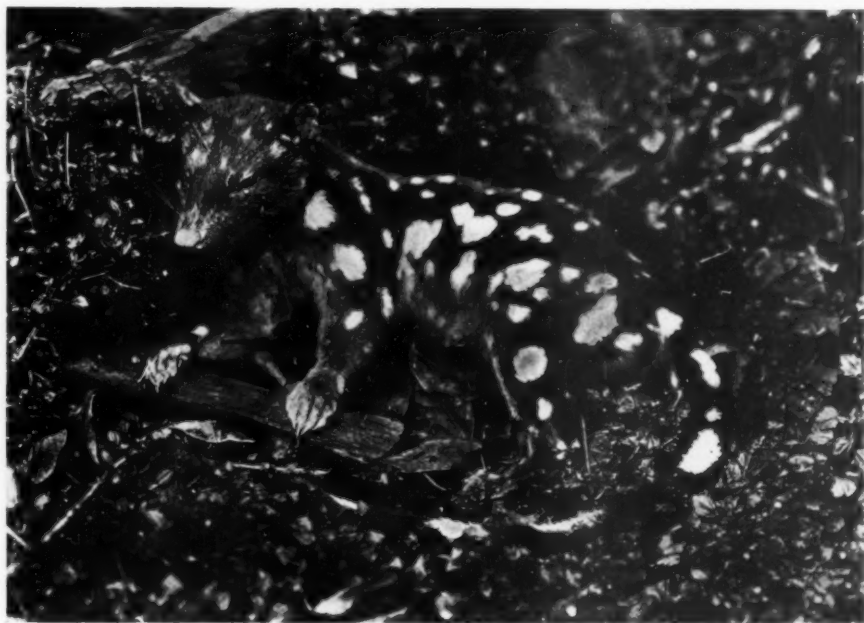
The Tasmanian wombat makes deep burrows in the sandy and rocky hills that surround the Arve Plain. A fox terrier can easily crawl into these burrows but cannot dislodge a wombat, should one be located. To do so, a man must dig in front of the animal



A young Tasmanian wombat.—It took three men digging from 3 P.M. till 1 A.M. to catch this youngster and his mother



The Tasmanian "devil" is doubtless a terror to the rats and small marsupials upon which it preys, but in captivity it is rather an interesting pet and gives no strong evidence of Mephistophelian traits



The native cat or spotted dasyure (*Dasyurus maculatus*) is one of the larger predatory marsupials of Australia. It is now being replaced by the domestic cat and the fox, both introduced by man



The spiny anteater (*Tachyglossus setosus*) feeds on ants and termites. With its powerful forelimbs it pulls apart the decaying logs and thrusts its narrow snout into the passageways made by the insects

living carnivorous marsupial, locally known as the "tiger," now, however, exceedingly rare. The Tasmanian "devil" was found in the forest, where it preys upon rats, small marsupials, and whatever other flesh and carrion it is able to obtain. One of the most curious of all the mammals of Tasmania was the spiny anteater (*Tachyglossus setosus*). This clumsy little monotreme wanders about the country both by day and by night, seeking its food, termites and ants, on the ground and in decaying vegetation, especially among fallen tree trunks, which are favorite nesting places of these insects. I was surprised to find this animal a good climber, an expert swimmer, as well as a marvelous burrower, able to dig straight down into firm soil. In climbing it makes use of its spines and snout to brace itself while securing a fresh foothold.

Before summarizing the rise and

decline of the Australian marsupials, it may be well to note that broadly there are three main lines along which marsupial adaptation has taken place. First, and relatively primitive, are the arboreal forms, which feed mostly on leaves. From this primarily arboreal, phyllophagous stock some groups developed terrestrial habits (e.g., the extinct *Diprotodon*, the wombats, etc.) and became highly specialized for nipping and grinding tough vegetation. The second line of adaptation includes the small, chiefly ground-living, insectivorous forms—pouched mice (*Phascogale*, *Sminthopsis*, etc.) grading to large, thoroughly terrestrial, carnivorous forms represented by the native cats, the Tasmanian "wolf," and the Tasmanian "devil." The third line is the essentially grazing-and-hopping type, represented by many species of kangaroos and wallabies. The tree kangaroo is only a specialized



The spiny anteater is an expert swimmer and a brook proves no obstacle to its traverse of the country

member of this group that has become secondarily adapted for arboreal life.

Another group of animals characteristic of Australia and of great interest consists of the monotremes, or egg-laying mammals. They take the place both of aquatic mammals and of anteaters in other parts of the world.

Everywhere may be found evidences of the vast damage done to the main lines of the adaptive radiation described above, and of the struggle that has been going on between the Australian marsupial mammals and the comparatively recent invaders, the higher mammals. Probably the Australian blackfellow of today and the wild dog, or dingo, arrived on the scene at about the same time and were the first mammalian competitors of the marsupials. The separation of Tasmania from the mainland, perhaps near the time of the

arrival of the blackfellow and the dingo in Australia, prevented the latter two from ever reaching Tasmania. The Tasmanian natives (now extinct) were probably in Tasmania long before the present blackfellow and dingo came to play a part in Australia's history. What may be the first evidence of a defeat of the marsupials at the hands of the invaders is the discovery of skeletons of two species of flesh-eating marsupials (*Sarcophilus* and *Thylacynus*), in cave deposits in New South Wales. These animals are no longer found alive on the mainland of Australia but are still extant in Tasmania, where the dingo did not get a foothold. By their habits they would naturally have come into direct competition with the dingo. I have seen a small dog quickly kill a Tasmanian "devil" and therefore do not doubt that the larger

dingo proved more than a match for the marsupial carnivores. The blackfellows were apparently never sufficiently numerous to endanger the marsupials as a whole, and as they preyed upon all sorts alike solely for food, the destruction of the native animals was not so marked.

With the advent of the white man conditions changed again. Probably the settlement of Australia by Europeans will account for the destruction of more species of native animals than did the growing aridity in recent geologic times, when many large marsupials perished apparently through lack of vegetation for which they were adapted. The skeletons of many forms of the large herbivorous marsupials which

died off at that time have been found in various parts of Australia.

The land the white people now occupy is naturally the most fertile part of the continent, consequently the part which supported the greatest number of native animals before they were driven off. Now these animals must occupy the less fertile areas and besides are killed by hundreds of thousands yearly for their skins; then, too, man has introduced dogs, which have become feral, strengthening the ranks of the dingo. He has also introduced other animals,—the fox, cat, and rabbit, which have taken to the "bush" and strengthened the current that has already set against the native fauna.



Unlike most of the Australian marsupials the small insectivorous forms (*Phascogale* and *Sminthopsis*) have no real pouch, just folds of integument surrounded by long hairs which cover and protect the young when they are very small. There may be as many as ten young in a litter

Bird Personalities of the Australian Bush

SOME FAVORITES OF THE PHOTOGRAPHER¹

By R. T. LITTLEJOHNS, R.A.O.U.

Assistant Editor of *The Emu*

AMONG those city dwellers who find "a pleasure in the pathless woods" there is a growing uneasiness because civilization has spread gaunt arms through the "bush" and has swept aside the wild life from many of its accustomed haunts. But the seasoned nature lover knows still a few spots, quiet and undisturbed, where he may shake the dust of the city from his feet and the worries of business from his brain. During the last fourteen years my own invasions of the wild have been made with a camera as constant companion, and the present article speaks of some Australian birds as a photographer knows them. The species I have selected are not the most remarkable nor yet the best known but simply those which, by their habits and their characteristics, have most endeared themselves to me. Many of them possibly will be unknown even by name, to American nature lovers.

The kookaburra, or laughing kingfisher (*Dacelo gigas*), on the other hand, is one of Australia's best-known birds, though that is not the reason for his inclusion here. It is because the quaintness of his appearance and manner appeals to me. He is a slow-moving, easy-going, thoughtful old fellow whose one aversion is to be hustled. His search for breakfast lacks that display of energy which characterizes the efforts of most species. He sits, pensive and motionless, on a limb or on a stump in earnest contemplation of the ground. Despite the nonchalant attitude, however, both eyes and ears are

fully employed, until sooner or later some hapless grub or insect betrays its presence by sound or movement. Then there is a heavy and rather slow flight to earth, the landing being effected literally on the stout bill. But if his methods are a little clumsy, they are efficient nevertheless and his period of watchfulness is seldom in vain.

In the ranges about twenty miles from Melbourne another camera enthusiast and I had the use of a weekend cottage a few years ago. Each Saturday our arrival at the house was noted by one or the other of a pair of kookaburras that resided in the vicinity, and their jovial, rather unmusical chorus sounded down the gully. By the time our luggage was unpacked they had taken up their favorite positions near the back door in anticipation of the weekly distribution of raw meat. In return for our hospitality we considered ourselves entitled to their portraits, but they regarded the camera with suspicion and continued snapping up the meat with expert beaks while on the wing. Eventually they were outwitted when we tacked the meat to a stump.

The only circumstance which ruffled the temper of these old birds was to have the impudent introduced starlings peeping into their nesting hole in an old gum tree near by. They appeared to regard the curiosity of certain small native species with good-humored tolerance. But those "furriners"; Ugh!

The yellow-breasted shrike robin (*Eopsaltria australis*) is another bird

¹All of the pictures accompanying this article, with the exception noted, are by the author.

with much the same thoughtful expression. It is not in any way related to the kookaburra; in fact, the little yellow robin settles the closer on her nest should the kookaburra appear in

the vicinity of it. Probably, almost certainly, the old humorist occasionally makes a meal of young "yellow Bobs." That is one of the few things I have against him. But nothing can be said



A bird of thoughtful expression is the old kookaburra. He is rather famous, too,—one of Australia's best-known species



Photographed by Mrs. R. T. Littlejohns

The yellow-breasted shrike robin is a quietly beautiful bird and a great favorite among nature lovers. "Breakfast in bed" is the human counterpart of the little ceremony here pictured

against the yellow robin. For quiet beauty he is unsurpassed and he is at once the most trustful and the most likable of our birds. Certainly he is the one most photographed and that speaks

volumes for his popularity. As a songster, however, he is an absolute failure, his vocal efforts being devoted almost entirely to one piping note, oft repeated.

A few years ago I cherished hopes that cinema pictures of Australian birds would be popular with or receive some support from Australian picture managements. I was quickly disillusioned but, after much pleading, I did induce one firm to give me a trial. Even this firm was not greatly kindled by my enthusiasm, so that it was extremely necessary that my first attempt should be a success. Without hesitation I sought the nest of a yellow robin and was not disappointed. A cinema camera in action rattles and roars prodigiously and, when operated but two feet from a nest, is sufficiently fearsome to terrify most birds. Yet in a very few minutes those yellow robins were performing their domestic duties with scarcely a trace of suspicion in their large brown eyes. The completed film showed clearly the breathing of the birds and photographically was as successful as I could have wished. The picture on page 31 was taken by my wife with an ordinary camera while the cinema whirled. It depicts that most touchingly human of all bird habits, the male feeding his mate upon the nest. I am anxiously awaiting the day when educational films of this class will be commercially possible in Australia.

The head of the yellow robin is a slaty gray while the back and wings are a greenish brown. The breast and underparts are lemon-yellow, the whole blending to make a pleasant picture. The nest, too, is a beautiful example of natural architecture. It is built of bark in an upright fork, usually near the ground, and is decorated externally with lichens and hanging shreds of bark.

Then there are the fantails, small fussy birds with tails which account for about half of their entire length. Their

flight is an erratic zig-zag, partly by reason of the extreme length of their tail and partly because of many side-ward dashes after passing insects. The white-shafted fantail (*Rhipidura flabellifera*) is one of the commonest of these birds and its pleasant metallic song is a feature of creekside music. The photograph shows the head of a trustful individual, the subject, also, of a "movie" film. Even if the picture conveys little idea of the appearance of the bird, it illustrates the characteristic cobweb and bark nest and shows clearly the stem, which is added apparently for the sake of stability. Three fully-fledged young fantails, piled high on the woefully overcrowded nest, is a sight to be remembered.

The yellow robin is my favorite bird; but there is another species of somewhat similar build which runs it very close in my regard. This is the brown flycatcher (*Microeca fascians*), familiarly known as the "Peter Peter" because its nesting call note may, with some imagination, be said to resemble those words. It is a dainty bird in every way with a very musical little song and plumage of soft browns and grays. While on the lookout for insects the brown flycatcher habitually swings its tail with a curious circular movement, during which two white outer feathers are prominently shown.

The brown flycatcher is also a builder in bark and cobweb and its nest, too, is a study in daintiness. It is a shallow structure, built so flat upon a horizontal branch as to be almost invisible from beneath. Often a small brown head peeping inquisitively over the edge of the nest just above one's head leads to the discovery of the home. The brown flycatcher usually chooses to make its dwelling in lightly timbered country, where small gum



The nest of the white-shafted fantail is a delicate structure of bark and cobweb, deep in the bowl and with a stem or tail added. This particular bird refused to leave her eggs even when handled

trees, with their lower branches dry and dead, are a feature.

When the young are hatched and clothed in streaked gray feathers, the difficulty of locating the nest is increased rather than diminished. One stormy day last spring I found a pair of

"Peter Peters" gathering insects with such enthusiasm that I knew there must be young birds somewhere near. There were but three or four trees in the vicinity which provided the class of nesting site that I knew the birds favored, yet I searched most carefully



The brown flycatcher is a small dainty bird of soft browns and grays, whose nest when newly built is rather attractive. By the time the young birds have grown to the stage shown in this picture the house presents a dilapidated appearance

for ten minutes without result. It was only when one of the adult birds visited the nest and fed the young ones that I discovered the little flat platform heaped high with young flycatchers. After much battling against the elements the accompanying picture was obtained. It will serve to illustrate the shallowness of the nest and its usual position. The choice of a dry branch as a foundation is prompted almost certainly by the fact that the eggs would be in great danger of rolling over the edge were the nest built on a swaying leafy bough.

The wood-swallow family is a typical and widely distributed one in Australia. In the southeastern corner of the Commonwealth there are three species, one a permanent resident and two summer visitors. All three are smooth-

plumaged birds of graceful soaring flight. The white-browed species (*Artamus superciliosus*), one of the visitors, is illustrated on p. 35. It is a striking bird with gray back, almost black head, and a bright cinnamon-brown breast. A conspicuous white eyebrow and a dark-tipped, slightly curved, blue beak give it a rather ferocious appearance. In point of fact it is unusually ferocious in the protection of its nest, and often the photographer is subjected to a prolonged attack during which his hat may be dislodged several times by an angry bird. The nest is a flimsy one of twigs and rootlets, built with much haste in a fork, usually near the ground but sometimes as high as twenty feet above it. As a rule a dozen or a score of pairs of birds make their homes in an area a few acres in extent, but



The Australian wood swallows are characterized by their graceful flight. The male white-browed wood swallow is here shown near the frail nest in a native shrub

never are two nests closer together than fifty yards or so. From a photographer's point of view wood swallows are not satisfactory subjects, yet there is some subtle attraction about the

proud defiance of their attitude which would induce me to go miles out of my way to see a nesting colony.

In suitable country one may find a dozen small holes drilled in a creek

bank within a distance of a quarter of a mile. Each small tunnel is the special property and the anxious care of a pair of pardalotes, whose cosy nest of grass and bark has been built in the darkness eighteen inches or two feet in the earth. The nearness of these nesting tunnels to one another is not an indication, as in the case of the nests of wood swallows, of any gregarious habit. Rather is it an evidence of the number of pairs which take advantage of a suitable nesting ground.

Around Melbourne there are two species of these small birds. One is much spangled with white and conspicuously marked with red orange and yellow. The other species is less gaudy, a plain brown bird with but a suggestion of yellow markings. Both

species have ridiculously short tails; in fact, short tails are characteristic of all the pardalotes.

Where the soil is very hard or otherwise unsuitable, the plainer bird, known as the red-tipped pardalote, will nest in the hollow of a tree or even in a fallen branch upon the ground. Such a position was chosen by a pair of birds whose domestic routine was interrupted, not once, but on two or three occasions, during a fortnight. On the last occasion young birds with lusty voices could be heard about two feet from the small round entrance hole.

Besides a pleasant, if rather monotonous, call, usually interpreted as "wit-e-chew," the pardalote has a plaintive little note specially reserved for pathetic occasions. Thus, when



The red-tipped pardalote builds a complete nest in the darkness of a tunnel, either in the ground, in a tree, or, as in this case, in a log lying on the ground. When prevented, temporarily, from reaching its home, the bird affects a pathetic attitude and utters a plaintive note of entreaty



The mistletoe bird builds a wonderful nest of feltlike texture. The small bird is here shown bringing two sticky mistletoe berries to the young in the nest

access to the nest was barred temporarily by a piece of stick, one of this pair of birds sat upon the topmost point of the branch and called most piteously in its distress. Each entreaty was accompanied by a peculiar stretching of the neck and a sidewise turn of the head, which I have attempted to illustrate in the accompanying photograph.

Pardalotes perform much useful service among the gum trees by attacking the noxious scale insect that plays havoc with the leaves and small branches. Although scarcely four inches long, the bird has an enormous capacity for this particular pest.

Related to the pardalotes and like them in shape and size is the mistletoe bird (*Dicaeum hirundinaceum*), a bril-

liant species not altogether uncommon but seldom observed closely. The height and speed of its flight may explain the fact that the bird is not better known. Some years ago, after much searching, Mr. S. A. Lawrence and I discovered the wonderful home of a pair of these birds about twenty miles from Melbourne. At the end of four days of hard and patient work we were able to take back with us pictures of both the male and the female; not only that, but these birds, admittedly among the least trustful in Australia, eventually fed their young ones while perched upon our hands.

The male mistletoe bird is beautifully colored. The throat is a brilliant scarlet while the back and wings are a glossy blue-black. The female is very soberly garbed in brown and gray and is scarcely recognizable as the consort of the male. During the summer months the birds are very partial to the sticky seeds of the parasitic mistletoe (*Loranthus*) as an article of food. In fact, when the berries are available, the birds appear to feed on little else. It is a curious partnership between bird and plant. In return for its gift of food the parasite receives the assistance of the bird in distributing its seed. It would appear, even, that the mistletoe is spread primarily through the agency of the mistletoe bird.

The nest of the species deserves mention. It is the most wonderful piece of work I have seen. Built of wool, where obtainable, and woolly substances taken from plants, it is woven so closely as to resemble felt. It is difficult to understand how the structure, lacking the long fibers we find in most other nests of the closed-in type, stands the strain of wind and weather besides supporting three young birds and one adult. It will be noticed, too, that the

slender branch above is the only support afforded to the breeze-swung home.

Of protectively colored species there are many, and all are interesting. The dotterels are particular favorites of mine, whose primitive nests among the pebbles of a creek hold some irresistible charm. In many of the old gold-mining districts of Victoria the whole countryside is strewn with stones and pebbles disturbed from their rightful places deep in the earth. Streams now meander through wide flat wastes of these pebbles and the usual creekside undergrowth has disappeared entirely, —a desolate enough scene.

When the dotterel's eggs lie unattended in the nest, they harmonize so well with the acres of pebbles that detection by natural enemies is most unlikely. In similar manner the sitting dotterel by its coloration enjoys almost complete protection. Even the downy youngsters, born open-eyed and able to run, are clothed in protectively colored down. At a note of warning from the ever-watchful parent they sink, with outstretched neck, flat upon the pebbles and appear literally to dissolve into the surroundings.

Now! I had not intended to mention the lyre bird (*Menura novæhollandiæ*), that greatest of all Australian bird wonders. Much has been written regarding it by ornithologists of standing, so that my only excuse for introducing pictures of the bird and its nest is my liking for the species. It is almost useless to attempt a description of the charm of "lyre-birding,"—I mean it in the harmless photographic sense. Imagine a half-mile climb from the main gully up the steep course of a trickling crystal stream. Realize that dignified progress is rendered impossible by tangled undergrowth, fallen tree ferns, and the sodden spongy

nature of the soil. Picture silver mists sweeping this way and that like great captive balloons and leaving twinkling drops of water on the tips of every fern frond. In the distance all the time ring the laugh of kookaburras, the carols of the magpie and the butcher bird, the screech of cockatoos and parrots, all falling one over the other in the ecstasy of the singer. Singer, I say,

The half-mile climb up the stream probably occupies half an hour and at the end of it a change is noted in the character of the country. One may now walk upright with ease and the ground is free of undergrowth and debris. The fern fronds form arches overhead and shed a soft green light over a scene which rivals fairyland. Above the ferns, myrtles and musk and



The black-footed dotterel—in the young stage as well as in the adult—is protectively colored, resembling the pebbles among which it makes its nest

because all the sounds come from the same direction, from the same throat in fact. Is there a mocking bird in any other part of the world which reproduces, not the laugh of one kookaburra but the jovial chorus of half a dozen; not the screech of one parrot but the din of a whole flock? If we attempt to reach the singer of these borrowed songs, we find the stage moved ever onward, so that we never overtake it. No! That is not the way to see the lyre bird.

Christmas bush clamber upward for the light, while blackwoods, still higher, do their very best to keep it from them. Above all tower giant gum trees, their wind-racked heads veritably in the clouds, their gnarled and spreading branches blotting out the last remaining patch of sky.

To the uninitiated this clearing, this change from the dense undergrowth, means nothing. To the experienced it presents itself as a likely nesting site



Although the lyre bird is credited with being exceedingly shy, the nesting female, at least, exhibits little more than a curious interest in intruders

for this mysterious bird. All is quiet, for, remember, most birds, being lovers of light, shun these places where sunshine is unknown. Then soberly, sedately down a natural path between the ferns walks the bird we seek; not the singer, but his mate. If she lived up to her reputation, she would turn and vanish like a shadow. But her nest is near and the female lyre bird,

when nesting, belies that reputation which she and her consort have earned, rightly or wrongly. Speaking from my personal experience I can only say that, unless one adopts fundamentally wrong tactics and scrambles through the undergrowth after them, both male and female lyre bird are almost as easily observed as other species. When her nest is near, the female looks upon



The large nest of the lyre bird is usually built near the ground but in a position which commands a view of all avenues of approach. The female was sitting in the nest when the photograph was taken

intruders simply with wonder, curiosity, and perhaps a little anxiety. Under such circumstances the only difficulty of the photographer is lack of light. But so serious is this one diffi-

culty that I have not yet seen a satisfactory picture of a lyre bird. The photograph reproduced is the best of three obtained after an expenditure of fifty plates.



Photograph by A. H. E. Mattingley

THE CARPET SNAKE

In the tropical parts of its range *Python variegatus* sometimes attains a length of fourteen feet, very rarely fifteen feet; in the more southern part of Australia seven or eight feet is its average size, though specimens measuring ten feet occasionally occur

Reptile Life in Australia¹

By CHARLES BARRETT, C.M.Z.S.

ON the trail of birds in Australian wilds with field glass and camera I meet with many members of the "cold-blooded" tribes. And, being one of those "eccentric persons" who feel kindly disposed toward lizards and snakes, I linger to watch their ways. I make no claim to the title of herpetologist; I am an observer only, and my budget of notes on reptile life is mainly for nature lovers.

Though fatal cases of snake bite in Australia are rather rare, we have our share of venomous serpents, and some kinds are abundant even near populous towns. In sparsely settled districts, where conditions are favorable to reptile life, snakes, both harmless and deadly, are very plentiful.

I have encountered many snakes in my "bush" wanderings, and with few exceptions have found them fearful of man, or at least decidedly anxious to avoid him. This applies to some of our deadliest species, including the black snake (*Pseudechis porphyriacus*), a formidable foe indeed, were it eager to stay and fight instead of avoiding trouble. This, our commonest species bearing the poison fang, often grows to a length of six feet, but the average length is sixty inches. Occasionally, "seven-footers" are killed; and snake stories record monsters worthy of exhibition in a dime museum!

The black snake is rarely aggressive unless cornered, or molested in the mating season, when most serpents are inclined to take the offensive against intruders. *Pseudechis porphyriacus*, when angered, flattens and expands its

neck, thus intensifying the terror of those who fear all serpents should they encounter one at close range. Nor is it wise for anyone to fence with this species in its rage. Strike swiftly, if you have the good fortune to carry a stick, and see that the blow gets home. Many a snake have I spared, but never a venomous one in fighting humor.

When camped near a jungley swamp in New South Wales a year or two ago, I met with black snakes daily. The swamp was an ideal home for them, and also for some harmless species of snakes. Orchid-hunting among the trees (*Mela-*



Courtesy of A. H. E. Mattingley

The black snake (*Pseudechis porphyriacus*) is beautiful in its coloring: purplish black or dark slate on the upper surface; on the sides and abdominal plates, crimson-lake red, with the hind tips and edges blackish. "Black Beauty," a snake-lover has called this dreaded reptile, which has taken its toll of human life

¹Illustrations, with one exception, from photographs by A. H. E. Mattingley, C. M. Z. S., and the author.

leuca sp.), slender-boled gum trees (*Eucalyptus* sp.), and splendid fan-leaved palms, I splashed along on the first morning afield, without a thought of reptiles. Suddenly, as I stooped to gather a lovely little bog orchid, a black snake glided past, almost touching my feet. I was startled, I confess, and for a while after that went warily. Then another "Black Beauty" appeared; and five minutes later, a third. At brief intervals three more were sighted, and I decided to quit the swamp. It was gloomy among the trees, and I might easily have found trouble.

On a track near the swamp, I surprised still another black snake. It glided toward cover, but was headed with the aid of a stick into a shallow pool. And there, like Brer Rabbit, it "lay low" for a time. It is a habit of the species to lurk, completely submerged, in swamps and streams. Some other serpents have the same power of remaining long under water. The black snake is viviparous, and its family may number from fifteen to a score. Its food consists mainly of lizards, frogs, and small mammals; it has a liking for young water rats, and in the stomach of one specimen sixteen of these were found.

Another deadly species, the brown snake (*Diemenia textilis*), has a wide distribution in Australia. It attains a length of six feet, and is greatly dreaded. The young are not produced "alive," the eggs, about a score to the clutch, being laid on the ground and concealed beneath twigs and dry leaves. The Australian copperhead (*Denisonia superba*), which must not be confused with the American copperhead, measures from four to six feet, and is plentiful in many parts of southeastern Australia, even close to the cities. During the summer of 1923, in a pad-

dock not far from Melbourne, the second largest city of the Commonwealth, a child gathering wild flowers was fatally bitten by a copperhead. I see this species every year, in the hot months, when rambling over heath



This water lily swamp is located near the Murray River in New South Wales

lands by the sea. One day, when out with a butterfly hunter, I learned to respect the copperhead. We came upon one basking, and my friend "stirred it up." In a flash the snake shot forward over the iron rim of the net

and struck. The entomologist missed death by a few inches.

Yet the copperhead is not regarded as our boldest and most aggressive reptile. That honor belongs to the tiger snake (*Notechis scutatus*), which



Photograph by Charles Barrett

The edge of a "flood" islet in the swamp is seen on the right of the picture. Hither large snakes come, chiefly to prey upon rabbits and other small creatures

also is one of the most venomous serpents in the world. It is partial to fairly dry areas, but is not confined to them, and ranges widely over the Commonwealth. Large specimens measure more than five feet from tip to tip, but the average length is much less. Ferocity, not size, makes the tiger the most dreaded of Australia's poisonous snakes with the exception, perhaps, of the sluggish death adder (*Acanthophis*

antarctica). Tawny crossbands and its vicious, aggressive nature explain the popular name. The tiger snake is brownish olive to dark brown on the upper parts, with many "tiger" bands, and below king yellow to pale straw yellow, or yellow tinged with green—handsome coloring.

The tiger snake abounds in places well suited to its needs. A mile or two from a crowded suburb, I have known it to attack a Boy Scout belonging to a camp in its territory. This species probably has taken a heavier toll of human life than any other reptile inhabiting Australia. It is said that its venom is more swiftly fatal than that of the cobra.

Far from avoiding man, the tiger snake is usually "looking for a fight;" in the mating season especially it shows its aggressiveness. At all times its fury becomes unbounded if it be attacked without a chance to retreat. Under such circumstances its neck is flattened, and expanded laterally to twice the normal width, reminding one of a cobra, with hood spread, ready for action, and if you are facing this tawny-banded terror, and are within its range, act swiftly or your fate is certain.

It is strange to read of a tiger snake being killed by a mouse; but this actually occurred. The late Prof. Frederick McCoy put a live mouse into a box containing a specimen of *Notechis scutatus*, and on the following morning was astonished to find that the little rodent had dispatched the snake by biting the back of its neck and, moreover, had eaten some of the flesh! The professor kept several tiger snakes together in a box, and frequently saw them bite each other viciously when they had been purposely disturbed; but the poison fangs produced no ill effects.



Photograph by Charles Barrett

The great brown kingfisher or kookaburra (*Dacelo gigas*) is a foe of small snakes, and sometimes kills fairly big ones. Young of the black, brown, and copperhead species doubtless are included in its menu. The author of this article has seen a "laughing Jack," which is another alias of this bird, perched on a fence post, with a snake three feet long dangling limply from its bill. It is generally believed that snakes are carried aloft by the kookaburra and dropped to the ground, so that they may be disabled, and thereupon safely and easily dispatched. This the author has not himself observed; but there is no doubt at all that "Jack" is a snake killer. That is one reason why he is protected

The death adder is one of the smaller serpents of Australia, seldom attaining a greater length than two feet. Its body is thick and rounded, the head broad and flat, while the tail ends in a horny spine,—harmless of course, but in popular belief the adder's deadly weapon. "It stings with its tail," folks say; and no logic has power to convince them of their error. The death adder is one of the most venomous Australian snakes; a large dog will succumb to the effects of its bite in eighteen minutes.

This *dead* adder, as it is commonly called, has a dangerous habit of lying still, often on soil with which its color harmonizes. Thus, it is not easily detected; and as it obstinately declines to yield the right of way, a pedestrian may tread upon it—and suffer death, for the adder strikes as swiftly as a furious tiger snake. One summer's day, when a holiday party was rambling in the "bush," a laughing girl placed her hand idly on a boulder. Next moment, when she chanced to look down, her face grew pale and she trembled. The hand was lifted in a flash—it had lain within six inches of a basking death adder!

Though the death adder is not aggressive, it will, when aroused, snap swiftly from side to side alternately, as I have seen a horned viper (*Cerastes cornutus*) strike, out on the Libyan Desert. But the Australian snake does not move its body sideways, in the peculiar manner of the Egyptian species. Sandy places are favored by *Acanthophis antarctica*, which is widely distributed in Australia; it is found also in the great island of New Guinea and its attendant islands. It was plentiful on an isle off the coast of North Queensland, where I camped for a while.

Among the snakes that are impressive because of their size is the carpet species, *Python variegatus*. This big rock snake is, of course, non-venomous, but not "perfectly harmless," as some naturalists aver. We captured one nine feet in length on a river isle in Queensland, three men grasping the tail and hauling *Python variegatus* from its retreat in a bed of swamp lilies. It was an exciting tug of war, but the snake lost. Later the specimen was shipped to Melbourne, and became for a time a household pet. I tested its crushing powers one morning, and very soon repented. Shining, merciless coils were about my waist, and the snake's flat, ugly head came gliding over my shoulder. Constriction increased, and the snake bit savagely at my coat. Tighter still it pressed, and breathing became difficult. I called on a watchful companion, and our united strength was exerted to unwind the reluctant coils.

But unless one is rough and careless in handling the carpet snake, it is harmless enough. Recently I photographed one of these reptiles, which allowed me to pose it, without protest beyond a mild threat from open jaws. This Australian python (we have several species of *Python*) is handsomely colored, pale brown with a greenish gray tinge and darker markings in irregular carpet pattern. Its tail is short and prehensile, and, like the American boa, the "carpet" coils it around a branch, and hangs by it as easily as a ring-tailed phalanger performs the same feat. A firm hold is gained (says Professor McCoy) with two little leglike spurs acting in opposition. Small mammals (wallabies, etc.) and birds are the carpet snake's chief victims, but it is fond also of poultry and raids henhouses in country townships.

Still, it renders good service as a rat hunter, and often its presence is welcomed in places where rodents abound.

The diamond snake (*Python variegatus spilotes*) is a subspecies restricted to portions of the eastern coast of our

house." When my friend entertained, he delighted in giving the guests a little surprise: the snake was coiled on a chair at the dinner table, and as a rule it behaved very well.

I come now to my favorites, the beautiful, slender tree snakes,—one



Photograph by Charles Barrett

This swamp in central Tasmania is a well-known haunt of snakes as well as a nesting place of crakes and rails. Undeterred by the proximity of the reptiles, a settler has built his cabin at the edge of the swamp

island-continent. It is darker than the carpet snake, and has a different color pattern: normally, diamond-shaped spots occur in clusters at more or less regular intervals. Northern Australia is the home of the black-headed python (*Aspidites melanocephalus*), which attains a length of eight feet; and another, smaller, species (*Aspidites ramsayi*) is restricted to a district in north central New South Wales.

Pythons sometimes are kept as pets. A friend of mine had a small diamond snake, which enjoyed the "run of the

being colored green, the other brown. As they glide among leaves of the jungle trees or, more rarely, over swampy ground, they resemble undulating tubes of tinted glass. All their movements are graceful, and their charm is enhanced by the knowledge that they are harmless. The common green tree snake (*Dendrophis punctulatus*) may grow to seven feet, but its more usual length is five or six feet. This species is abundant in subtropical and tropical "brushes" on the eastern coast. I have seen a dozen during a

morning's ramble among palm trees and cedars in a northern "brush." The swamp described on pp. 43-4 where black snakes were so numerous, was also a haunt of green tree snakes. I found a pair at home in a hollow log, and saw many others gliding through water-laved grass and ferns or among the foliage of trees. Small birds and lizards and the tree frogs so plentiful in their haunts are victims of these snakes, but their diet is, perhaps, varied with other little bushland creatures. The brown tree snake (*Dipsadomorphus fuscus*) is a nocturnal hunter of small birds, lizards, and amphibians. Its maximum length is seven feet. The tree snakes are oviparous.

In tropical Australia there are four kinds of true fresh-water snakes, placed in four genera by systematists; but I have no personal knowledge of the ways of these reptiles.

Sea snakes, which prey chiefly upon fishes, are not uncommon in our tropical waters, especially among coral reefs, where I have seen them during trips to islands of the Great Barrier. They are found, also, in salt-water estuaries. I will freely admit that I prefer to view sea snakes at a little distance. They are highly venomous; and in traversing water lanes that run through coral causeways or along the reef's edge in a blue lagoon one is wise to be cautious.

Our most familiar species among the Hydrophinae is the yellow-bellied sea snake (*Hydrus platurus*), which rarely grows to a length of more than three feet. It is black on the upper surface, yellow on the sides of the body and the lower parts, while the tail varies in color pattern,—yellow with black spots, or the reverse. This species is found in the Pacific and Indian Oceans, authorities say, and is recorded from Panama

waters. My own slight knowledge of it was gained in North Queensland.

White-bellied sea eagles (*Haliaetus leucogaster*) are great enemies of sea snakes. On an isle of the Capricorn Group, off the coast of Queensland, I found beneath the nest of a pair of sea eagles scores of skeletons of sea snakes. Sharks, also, it is said, prey upon these serpents. Their own element is sometimes their enemy; for after a storm sea snakes have been found cast up on ocean beaches.

Of crocodiles we have two species, Johnston's (*Crocodylus johnstonii*), a native of Northern Territory and North Queensland, and the salt-water crocodile (*Crocodylus porosus*). The length of the former is from six to seven feet; it is mainly a fish eater, harmless to man. One of my naturalist friends has bathed often in a Queensland river pool among the "little crocs." This practice is not exceptional, for the folk who live in districts where Johnston's crocodile abounds have no fear of it. *Crocodylus porosus*, on the other hand, a monster often measuring seventeen feet or more from the snout tip to the end of the powerful tail, is regarded with due respect. It frequents the tidal mouths of creeks and rivers, and sometimes is met with at sea. It is not confined to northern Australia, being a native, also, it has been stated, of India and Ceylon, some Pacific islands, and the southern portion of China.

Mr. A. H. E. Mattingley, C. M. Z. S., a noted Australian naturalist, relates an adventure with a salt-water crocodile.¹ He was hunting birds in the mangroves, when he came upon a female crocodile in a wallow beside her nest. She made a savage rush at him, with "a kind of hissing, grunting noise,"

¹The Animals of Australia, Lucas & Le Souëf, pp 190-91.



Photograph by Charles Barrett

Green turtles coming ashore from the lagoon at Masthead Island, in the Capricorn Group, Queensland, where they deposit their eggs in burrows

but was blinded by a charge of small shot and finally dispatched.

When living in North Queensland, my wife received from a grateful person, whom she had nursed through an illness, a baby crocodile. The gift, from a rough but kindly old miner, arrived without warning in a box the lid of which was nailed down. My wife and her friends of the household were curious as to the contents, and bent over the box as the top was pried off. When the crocodile's head popped up, the sharp-toothed jaws agape, all the human heads were lifted high in a flash. The gift, with a polite note of thanks, was returned to the sender, who later explained, "I thought you'd like it for a pet."

Wild pigs are killed and devoured by the salt-water crocodile, and it has the reputation of being a man-eater when the chance occurs. It is not particularly conducive to long life to swim in, or wade through, pools in crocodile-haunted water courses, for the reptiles sometimes seek a change from salt

to fresh water and travel far upstream.

I am more at home in writing of green turtles (*Chelone mydas*), for I have camped on their nesting isles, swum among them in the lagoons, and even commandeered them for "joy rides" on the beaches. The green turtle, which frequents tropical and subtropical seas, is so abundant in the breeding season among our north-western and northeastern islands that hundreds sometimes are seen at a sweep of the eye. One morning I actually counted nearly two hundred on the beach at Northwest Island, in the Capricorn Group. Many were coming ashore, too, and dark heads dotted the sea as far as my eyes could range. It was easy to steal to a basking turtle and leap upon its carapace. If you gained a firm seat (kneeling on and grasping the front of the carapace), a brief ride to the sea was possible. In the water the turtle triumphed. It might swim for a time with head uplifted, but presently it would sub-

merge, forcing its rider to loose his hold or drown. I never could rival De Rougemont in turtle-riding feats; but many a big *Chelone mydas* has borne me over the beach to the sea.

At night, on the edge of the jungle zone, the female turtles excavated big holes in the sand and therein laid their eggs. Then they scraped damp sand into the hollow again and smoothed the surface, using their hind flippers adroitly in these operations. All was safe now, they believed, and accordingly they returned to the sea.

Many nests are robbed, of course; and turtle hunters often capture the luckless owners, as they hasten seaward after laying and hiding their eggs. Rarely, among the islands, we saw the logger-head turtle (*Thalassochelys caretta*), noted for its shell-crushing beak.

We have in Australia some interesting tortoises that inhabit lakes and rivers and the large lagoons. The long-necked river tortoise (*Chelodina longicollis*) is one of the most remarkable species, common in rivers of southern Australia, especially Gippsland, Victoria, where I have met with it. The length of the snake-like neck, from the front edge of the carapace to the occiput, is about three inches, six lines, sometimes shorter, rarely a line or two longer. This is rather a handsome reptile, very dark brown above, with the plastron and under surface of marginal plates a rich yellow, the borders to the sutures being dark brown. The pure white eggs (from seven to more than a score) are deposited in a circular hole excavated in a bank, the tortoise using its hind feet for the work.

The Murray River tortoise (*Emydura macquariae*) is popularly known as the Murray "turtle," but a glance at its feet shows the naturalist that it is one of the walking tortoises, wide-



Photograph by Charles Barrett

The carapace of a green turtle found on the beach of Coral Island

webbed between the toes, and provided with long, acute claws. In a lake in northern Victoria I saw in early summer time a host of Murray tor-



Photograph by Charles Barrett

The burrow from which these eggs of the Murray tortoise were removed is seen to the left rear of them



Photograph by A. H. E. Mattingley

Supported by its adhesive toe pads, the Australian gecko is able to hang head downward from a branch

toises. They were gathered in warm, shallow water along the shore, and I followed the tracks for fifty yards until I came upon several nests excavated in dry soil. From one of these nests nearly a score of eggs, white and soft-shelled, were taken. Egg fights are held by schoolboys living in the neighborhood of the lake; but the turtle population does not decrease perceptibly though hundreds of eggs are destroyed.

Australia is so rich in lizards—nearly four hundred species, and many of them abundant—that I can mention only a few, notable for their quaint appearance or their engaging ways.

Our geckoes are queer little creatures, with grotesque tails and in the case of some species ogre-like heads, so that it is not strange that many persons regard them with aversion. But I like every kind I have seen. Under bark on living tree trunks and gray old logs on the ground, in rock crannies and beneath

big boulders, geckoes are found. Some kinds, especially in the subtropical and tropical parts of the Commonwealth, take up their abode in houses, huts, and outbuildings, where they prey upon moths and flies. Their adhesive footpads enable them to run up and down walls, and across the ceiling of a house. Sometimes they lose their hold and fall. One night I was seated, reading, in a Queensland bungalow, when a gecko dropped on the table, an inch from my book. He did not stay to apologize, but scampered down a leg of the table, across the floor, and up the wall, back to his hunting ground—the ceiling.

In the arid country of central Australia are found our strangest geckoes. One is *Nephrurus asper*, pale pinkish brown on the upper surface, with a black band on the neck, and black lines in network pattern on the head. It is under five inches in length. The small tail has a "terminal enlargement"; at the base it is swollen in a curious manner, then it tapers, and ends in a globe-shaped knob. *Rhynchodura ornata*, of northwestern Australia, is more remarkable for the shape of its head than for that of its tail, though the latter organ is sufficiently strange,—thick, and in outline like a malformed leaf. This gecko's head suggests that of a baby bird, with bulging eyes and short, blunt bill.

Some of our lizards are gorgeously colored,—for example, the painted dragon (*Amphibolurus pictus*), which inhabits dry regions mainly, in western, central, and southern Australia. The male, on the upper part of the body, is brick red, with leaden-blue vertebral stripe; the sides are blue with yellow spots; the limbs bluish black with some yellow markings; and the long, tapering tail leaden blue, barred with light-colored, narrow bands. Truly, a



Photograph by Charles Barrett

Though living close to the ground, the bearded dragon, *Amphibolurus barbatus*, likes to bask on logs and stumps and fence posts. Annoyed or cornered, it expands its "beard"—a frill of spines—and faces the foe open-mouthed, hissing viciously the while. It will bite, too, in savage earnest, but without causing much pain. Its display is largely bluff, but succeeds sometimes in scaring very timid persons. The "dragon," although about twenty inches in length, has no chance of life when pounced upon by even a small dog. A fox terrier will dispatch two full-grown specimens in less than five minutes.

dandy; but not the only one among Australian lizards to qualify as such. One small species has an orange-red tail, and blue-and-black striped body.

Another kind, of the purely Australian genus *Egernia*, varies greatly in coloring; one form is bright brick red above, with some black spots; while the sides

of the body are pinkish brown, also spotted with black, and the under surface of a rich, creamy-white hue. Brown, blue, red, yellow, and many other colors are exhibited by our lizards, large and small.

We have some lizards, however, that are "plain." The bearded dragon (*Amphibolurus barbatus*) is as soberly colored as a Quaker's coat. Dingy brownish or yellow gray is the prevailing tone, with darker markings in some cases. I have met with this queer lizard, which attains a length of about twenty-one inches, in many places, but most often in the wonderful Mallee country of northwestern Victoria, where the lowan (*Leipoa ocellata*) still raises mounds of soil and débris as incubators for its eggs, ranged in tiers in a hotbed. The bearded dragon, however, is found all over Australia, except in the areas farthest north. It is so common in the Mallee that a score may be seen in a morning afield. A dozen or more eggs are laid by this species.

Fortune has favored few naturalists with an introduction to the true frilled lizard (*Chlamydosaurus*) in its native wilds; and I am one of the luckless majority. *Chlamydosaurus kingii*, sole member of its genus, inhabits certain areas in western and northwestern Australia, and Queensland. Its body is slender, and the tail, proportionately, of remarkable length; from tip to tip an adult may measure almost three feet. The big frill is wonderful; but a still greater claim to distinction is this lizard's habit of running erect on the hind legs. Saville-Kent, who closely observed the species, states that in running the frilled lizard places on the ground only the three central digits of each hind foot; thus its tracks resemble those of birds and of dinosaurs.

The horned dragon (*Moloch horridus*), under nine inches in length, is a contrast to the frilled lizard in its sluggish ways. It is difficult to describe this quaint little reptile, with its rows of large and small spines, neck hump, and horned eyes. It is of a yellowish color, with chestnut-brown markings. The Australian *Moloch* lizard resembles the Texas horned lizard (*Phrynosoma cornutum*).

The horned dragon, often called "thorny devil," makes a pleasing pet. One of these lizards had the freedom of my house for a month, when it met with an untimely death—crushed by a careless foot. Another specimen I purchased for a shilling from an aboriginal at Coldea station, on the Trans-Australian Railway. I kept the lizard in my sleeping compartment on the train, and when we stopped for some minutes at a station, I would step out and place it on the ground among ants of different species. But it declined to eat in the midst of plenty. Later I learned that the *Moloch* has a special liking for the small black "sugar" ants, which commonly nest in our gardens and invade kitchens and larders. Given its favorite food, this lizard develops an amazing appetite, often devouring more than one thousand ants at a meal. The insects are picked up one by one by the reptile's slender and sticky tongue, which flashes in and out of the mouth tirelessly till the feast is ended.

Dr. J. Bequaert¹ refers to *Moloch horridus* in his fascinating paper on "The Predaceous Enemies of Ants."¹ I have evidence that our horned lizard lives solely upon ants, though apparently it is highly selective and never troubles the great majority of species.

¹Bulletin, Am. Mus. Nat. History, Vol. XLV (1921-22), p. 296.

A captive specimen was tempted with living ants of several species, but declined to eat until it was placed beside a nest of the small black ants already mentioned.

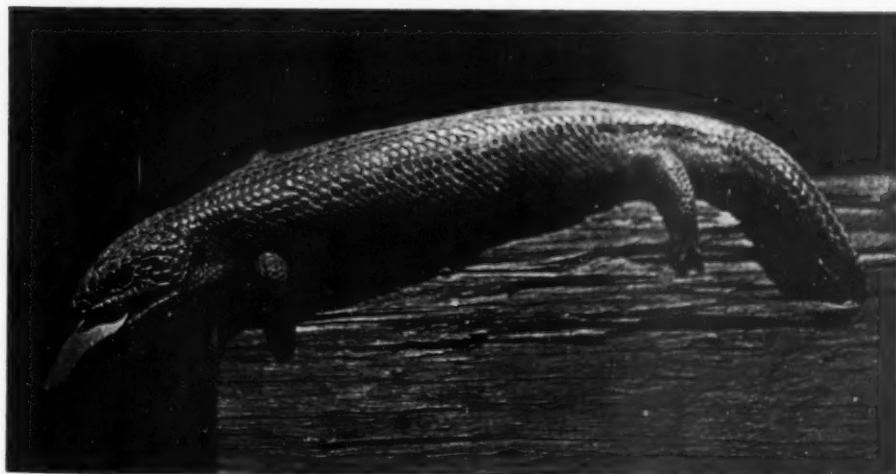
My brother, in camp on a western gold field, where fortunes were lost and made, kept, as a mascot and "servant" combined, a fine little *Moloch*. It was tethered lightly to a tent peg and rarely strayed to the end of its tether. It cost nothing to keep and needed no attention; but it rendered welcome service in devouring hosts of black ants.

Australia's sluggish blue-tongued lizards (*Tiliqua*) are unfriendly in their haunts, but in captivity become more sociable. I have had several and have found them rather engaging despite their indolent ways. A "blue-tongue" is never in a hurry; but if you irritate him, he instantly shows bold resentment. The jaws are opened and the bright purplish-blue tongue flickers while the body swells and a fierce hissing noise is uttered, as if it were being pumped from the depths. These reptiles, of course, are harmless, but

their display must serve to frighten some of their natural enemies. In the Mallee scrubs, I have seen a "blue-tongue" smaller and more brightly colored than the common species (*Tiliqua scincoides*), the average length of which is nearly two feet.

"Shingle-back," "stump tail," and "sleeping lizard," are the popular names for the most sluggish of all the Australian reptiles (*Trachysaurus rugosus*), which enjoys a fairly wide range. In northwestern Victoria and South Australia (near the coast), I have observed shingle-back lizards in number. In one spot, more than twenty were present, not in association but within a few yards of one another. The place must have had some special attraction for the lazy, dull-colored reptiles.

The stump-tailed lizard measures from a foot to fourteen inches in length. Its curious, broad and short, stumpy tail might be mistaken at a distance for the lizard's head, though smaller and more rounded. In some districts, indeed, the species is known as the two-headed lizard. Its appearance plainly indicates that nature never intended



Photograph by C. P. Kinane

A blue-tongued lizard (*Tiliqua scincoides*) in angry mood, with its purplish-blue tongue in action



Photograph by Charles Barrett

This brood of young brown hawks (*Hieracidea berigora*) was fed mainly on stump-tailed lizards (*Trachysaurus rugosus*). There was a half-devoured specimen of this lizard in the nest when the photograph was taken

that it should live an active life; nor does it break her law. A snail might win a race with *Trachysaurus rugosus*. The lethargy of our stump-tailed lizard is so great as to be diverting to an observer of its ways. Like some creature of a poet's fancy, this indolent reptile



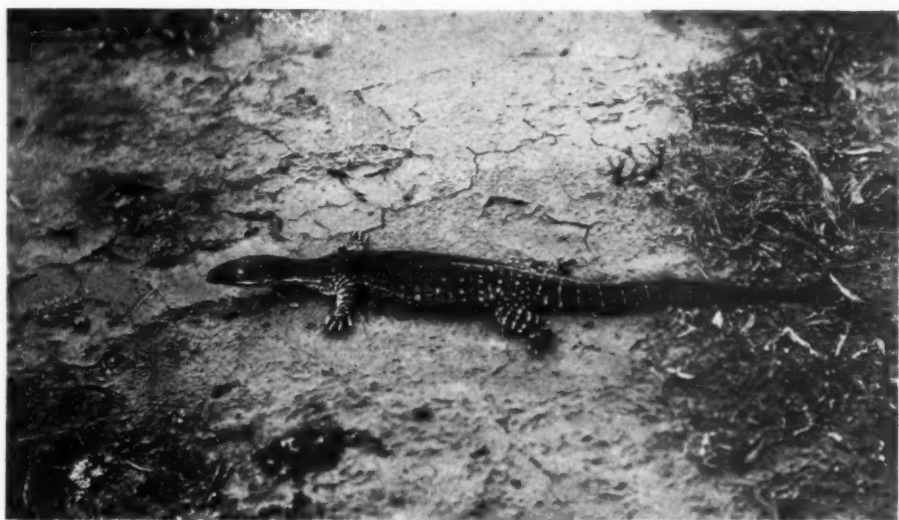
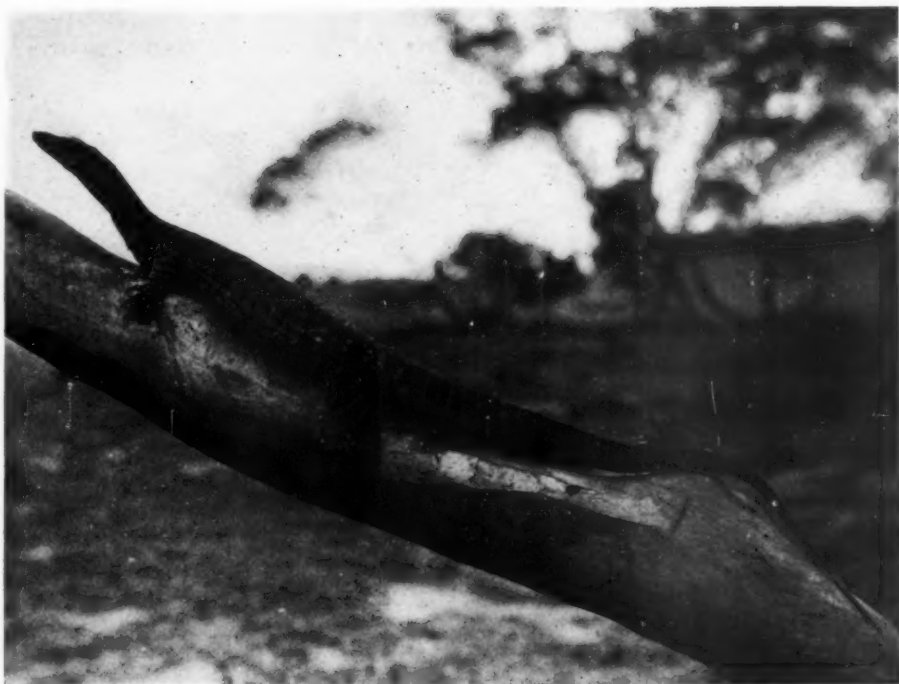
Photograph by Charles Barrett

The stump-tailed lizard is also known as the double-headed lizard, a not inappropriate name as any one taking a quick unanalytic glance at this picture will admit. The photograph was taken in the Mallee country, Victoria, and shows the sluggish lizard stretched on the sand

"drags its slow length along"; only it is short instead of elongated; it waddles on its stomach, one might say.

In my latest trip to the Mallee (October, 1922) I noticed that brown hawks (*Hieracidea berigora*) were feeding their broods on stump-tailed lizards, varied with larger, and very active, species. Remains of several specimens of *rugosus* were found in a hawk's nest, and the mother bird was seen approaching with a young monitor lizard (*Varanus* sp.) dangling from her beak. Stumpy has no defence against a bird of prey; he may be sighted and captured at leisure for the mere trouble of alighting on the ground to pick him up. It is different with the monitor.

This brings me to our largest lizards, in popular parlance "goanas"—a corruption of iguana, I suppose. We have no iguanas in Australia, as every naturalist knows; but "guanas" our monitors will be called for many years



Photographs by Charles Barrett

THE MONITORS OR "GOANAS"

The genus *Varanus* includes the largest of Australia's lizards. One species, *V. varius*, attains a length of six feet; scarcely less impressive is *V. gouldii*, which is more than four feet in length. There are also intermediate and small species in the genus. The lace monitor (*varius*) is essentially a tree-climber and takes ruthless toll of birds' nests, the young birds as well as the eggs being eaten. When the close of the nesting season puts an end to its raids among the trees, this lizard takes to the ground, preying upon rabbits and other animals. Gould's monitor, on the other hand, lives habitually on the ground

to come. It is difficult to lay the ghosts of popular errors. Of these long-headed lizards we have several species and varieties. At least two of the species are of considerable size, as "big as alligators," to quote a newspaper heading; others are from two to three feet in length; and finally, there are species smaller still.

The lace monitor (*Varanus varius*), mainly an arboreal lizard, inhabits eastern Australia. It varies in length, full-grown examples measuring about six feet. This reptile is a great enemy of birds. It climbs the tallest trees with wonderful facility, and few nests are safe from its raiding. Sometimes the big robber is driven off by bold and powerful birds, such as the cockatoos; the smaller birds can only threaten and loudly protest while their homes are devastated. Very often, of course, the parents are away, and the monitor gets his meal without any annoyance.

When harvest time for eggs and nestlings is over, the lace lizard seeks a living on the ground. It hunts rabbits and small native mammals, snaps up "unconsidered trifles," and in the settled districts visits poultry yards, stealing both eggs and chickens. Often I have been startled by the sudden rush of a "goana" that had been lurking in long grass or among rocks and scrub on a hillside. In a second, if a tree be handy, a monitor surprised on the ground will be racing up the trunk. It will dodge round if you watch it, keeping on the side of the bole you cannot for the moment see. "Goanas" have been killed in large numbers for the sake of oil distilled from their fat, which is valued as a remedy for various aches and pains.

Gould's monitor (*Varanus gouldii*), which ranges all over Australia, is

smaller (length up to about four feet) and more handsomely colored than *Varanus varius*. Another fact in its favor is that it is less voracious and vicious than the larger "goana." Furthermore, this lizard lives mostly on the ground; alarmed, it seeks as a rule safety in holes in the earth instead of climbing a tree. Although it swims well, it is most plentiful in waterless areas. Captive specimens hiss loudly when irritated, but do not attempt to bite; at other times, to quote Professor McCoy, they give "a gentle snuffing sort of cough, such as babies emit before they are weaned."

Many rivers and creeks in eastern Australia (from Queensland to southern Victoria if varieties of the species about to be mentioned are disregarded) are frequented by a strange reptile, *Physignathus lesueurii*, known as the water lizard, or water dragon—the latter name seems most suitable when the reptile is seen "at home." Lately this reptile has become famous among thousands of people previously ignorant of its very existence. Its claims to the title of "bunyip" were advanced by some "bush" dwellers during a discussion in the columns of the *Melbourne Herald* regarding that mysterious creature of native legendary tales and white men's camp-fire stories.

Maybe, there is a real bunyip, an animal remotely resembling the imaginary creature feared for centuries by the aborigines, if indeed they had perfect faith in their tribal tales. A seal astray far inland, in river or lake, may have given rise to the bunyip legend, and the boom of the bittern may echo in its "terrible voice." Descriptions of the bunyip vary among the tribes; but the legend is wide-spread, and many persons, even today, believe that Australia is the home of a large and

wonderful animal, unknown to science but familiar to black fellows! "Blood-curdling screams," heard at night in the "bush" not far from Melbourne, were attributed to the bunyip. Most probably they were uttered by a powerful owl (*Ninox strenua*) or a koala (*Phascolarctus cinereus*), both noted for making unearthly noises.

Dozens of theories were advanced, but the mystery remains unsolved. The theory that interested me was that propounded by some young men camped near a creek frequented by water dragons, and published in the *Melbourne Herald*. "A lizard is responsible for the bunyip scare," the campers declared; and they described how the reptile, the length of which is about thirty inches, rested upon a rock in the creek, and inflating its cheek pouch, produced "unearthly sounds." I have seen many water dragons in their haunts, but have no personal knowledge

of their vocal powers.

The color of the water lizard on the upper surface of the body is dark olive, with cross bands light and dark. The cheek pouch is vividly colored in lines of rich yellow and blue. An expert swimmer and diver, this reptile is not entirely aquatic in its habits. It frequently is seen on the banks of streams or basking on rocks in the current. At the least sign of danger it dives into the stream and swims out of sight. Rambling beside a rocky Gippsland creek on a hot day, I came suddenly upon a "colony" of water dragons. Before I could focus the camera every lizard had splashed head first into the water. The prey of the species seems to consist chiefly of insects, including native bees.

Only vignettes have been given of reptile life in Australia; the subject deserves large volumes.



Photograph by Charles Barrett

A creek in Gippsland, Victoria.—The rocks in the stream and along the banks are frequented by the water dragon (*Physignathus lesueurii*)

The Vanishing Wild Life of Australia

THE CAUSES OF THE SCARCITY OF CERTAIN OF THE NATIVE ANIMALS
EXPLAINED BY A. S. LE SOUËF

THE preceding articles have introduced the reader to the strangely primitive mammals, the birds, and the reptiles of Australia, and the doom of extinction that has overtaken some species and that threatens others has been alluded to here and there. By way of supplement to this phase of the subject, it seems in order to print a substantial portion of an article entitled "The Australian Native Mammals," which Mr. A. S. Le Souëf contributed to a recent issue of the *Australian Zoologist*.¹

The fact that some of our native animals are getting increasingly scarce is well known to those familiar with them in their native haunts. Mr. W. W. Froggatt drew attention to this matter (*Proc. Linn. Soc. N.S.W.*, 1913), but little else of an authoritative nature has been published. Much uncertainty and misapprehension has been caused by many people writing and speaking about the matter without having any basic knowledge of the subject.

Actual facts are rather difficult to secure, as comparatively few people take sufficient interest to make observations, or can recognize any but the common species when seen. In the absence of any comprehensive survey this resumé is only approximate.

The cause of the disappearance of some of our animals can be stated to be (in order of importance²):—

- (a) Introduction of the fox, the cat and the rabbit.

- (b) Shooting and trapping for the fur market.

- (c) Opening up the country by settlement.

- (d) Disease.

(a) The Marsupials are representatives of animals that appeared very early in the history of evolution; they were in process of time completely superseded by the more advanced animals that we know today. The isolation of Australia at a time when the Marsupials were predominant, allowed them to remain unmolested, except for the later introduction of the dingo. With no competition except among themselves, they have stayed in their primitive state—remarkably harmless and with a low instinct of self-preservation.

When animals of this class suddenly find themselves placed in competition with such advanced forms as the fox, the cat and the rabbit—types that are far ahead of them in the evolutionary scale—it is just as inevitable that they should go down before the invader, as that the aboriginal should give place to the white man.

The fox is by far the greatest menace that our wild animals are faced with. It is widespread, uncontrollable, and reaches places where man has not penetrated. Its progress towards northern and central Australia will be watched with interest; if it can establish itself in the dry and also in the tropical areas, then a great many of our animals—some hardly known to science—will disappear. So far there is no evidence that it can live away from permanent water or in the tropics. It is significant that most of our animals live in the driest areas, getting their moisture from roots, bark and insects. The rabbit, the cat and the European mouse have already spread over the continent; the rabbit thriving in waterless areas in good seasons and

¹Vol. III, Pt. 3, issued June 7, 1923.

²Different students of the Australian fauna will assign a different order of precedence to the agencies of destruction. In the article which Mr. Raven contributes to this issue, first place is assigned to man, while the fox is subordinated as a destroyer to the dingo. Though such differences of viewpoint will continue to prevail according to the experiences of the individual writer, there is no difference of opinion on the point that all of these agencies are tending to deplete the native wild life.—Editor.

being swept off again in dry times—but I do not think that they have any marked effect on the native animals.

Mr. Le Souëf then alludes briefly to the presence, in the eastern coastal areas extending from Victoria to North Queensland, of the poison tick (*Ixodes holocyclus*), which is of aid to the marsupials in that it is "fatal to canines and somewhat less harmful to cats." He calls attention to the fact that Tasmania and the islands off the coast are free from the fox but that this animal has spread along the south of Australia and has reached as far north as Geraldton in Western Australia. The depredations of the fox as they affect particular native animals are then considered:

In New South Wales the only species that are holding their own, as far as I can judge, are the larger kangaroos, the Wombat¹ and the Platypus. The Red and the Gray Kangaroos, owing to their gregarious habits and their size, are fairly safe. The Wombat is too doughty an animal for the fox to tackle, while the Platypus is protected by its environment. A large animal that seems to be affected is the Wallaroo; this species lives singly or in pairs or at most three or four together, and the female is often alone. It has been stated by observers in the Monaro District, that when a fox finds a female with young in the pouch, he chases her until the "Joey" is thrown out; this is then secured and killed. . . .

(b) The insatiable demands of the fur trade form the second heavy drain on our native animals. This trade should

absorb only the natural increase, but the machinery for control is lacking, and the laws make very little difference in the number of skins taken and exported.

(c) The opening up of the country by settlement has had its effect on the native game. The first stage, after upsetting the balance of life, was an enormous increase in the Marsupials, but systematic killing and the advent of the rabbit and the poison cart soon stopped this.

(d) Under normal conditions there is a very correct balance of life among the wild animals. Occasionally, in the absence of natural enemies, a species will increase to such an extent as to overtake the food supply; then in their weakened condition, disease is apt to break out in a virulent form and sweep them off in thousands.

After citing several local instances of the decimation of particular animals through disease and after recapitulating some of the statements previously made, Mr. Le Souëf suggests certain remedies, including a zoölogical survey and the restriction of exports to the surplus or ordinary increase of each species. Toward the end of his article he states:

The asset of the fur trade has given Australia millions sterling in the past and will, if preserved, do so in the future; but unless control is based on accurate knowledge, it may be frittered away. At present it is nobody's business to ascertain what species of animals' skins are leaving the country, but if a small export tax were imposed, they would have to be examined. The funds so collected could reasonably be used to preserve the asset.

¹In the northern part of New South Wales the wombat is now practically extinct.—EDITOR.

The Great Barrier Reef of Australia

By CHARLES HEDLEY

Principal Keeper of Collections, the Australian Museum, Sydney

IT is only in the warm seas that corals grow, and the warmer the water, the more luxuriant is the bank, or technically reef, which they build. Thus, as we sail southward in the Atlantic and pass the Bermudas and Bahamas, first one kind of coral and then another appears, till in the West Indies the coral becomes rich enough to display its architecture of reefs, atolls, and lagoons. But even in the West Indies the coral does not attain perfection. During the warmer phases of the Tertiary, there were many genera and species of coral in the Caribbean Sea which now have become extinct in those waters. For the most part these extinct forms are, however, still represented in the Pacific, so that to find the full development of coral growth we must leave the Atlantic and traverse the other great ocean. As one travels west, the variety of coral becomes greater, till a maximum is reached in the Philippine-Papuan-Solomon region. The greatest single structure which the coral has achieved, now or in the past, is the Great Barrier Reef of Australia. This extends along the coast of Queensland for more than a thousand miles. At the tropic of Capricorn, the southern end of the Great Barrier fades gradually away, the species of coral becoming fewer and the reefs smaller and more widely separated as the colder water represses their vigor and finally extinguishes them. In the north the Great Barrier Reef terminates more suddenly. From the high mountains of New Guinea numerous large rivers pour into Papua Gulf, and their muddy waters extend far out to sea. After

cold, the greatest enemy of the coral is mud. Thus, a mud line formed by the Papuan rivers limits the coral islands of the Great Barrier. The soft corals, or Alcyonaria, can endure more mud than the stony corals. The eastern face of the Great Barrier is also sharply defined. From the coast of Queensland a continental shelf, from twenty to eighty miles in breadth, extends to the edge of the coral sea or, more strictly speaking, the Carpenter Deep, and there plunges down steeply to the abyss. Along the edge of this continental shelf is built the seaward wall of the Great Barrier.

The Great Barrier does not, as its name might suggest, hug the coast of the mainland. It is roughly parallel to the continent, but the space between reef and main is as wide as that between England and France.

The outside edge of the Great Barrier takes the form of narrow banks, each a few miles long followed by a break or channel of a mile or two, and continued in a general north-south direction by a chain of similar banks, most of which are covered at high water. Meeting this sunken obstacle, the ocean swell from the Pacific leaps up in a tremendous wave and falls with a crash and a smother of foam upon the reef. Passing in a vessel through one of the breaks or passages, the traveler receives an impression of an endless ribbon of foam, arising from no apparent cause and running across the ocean from horizon to horizon.

Outside of these banks and passages soundings fall away steeply to the abyss. Few mountain ranges present a



A channel between two islets hedged in by mangrove

wall so huge and steep. Probably a high rampart of coral has here grown up from a foundation of the slowly sinking continental shelf. As yet next to nothing is known of the thickness of the coral at the margin of the Great Barrier, but soundings indicate that it is at least many hundreds of feet deep.

The channels through which ships may traverse the Barrier Reef from the Lagoon Channel to the open sea mark, it is popularly supposed, the site of old river beds. A brief examination of these channels will dispel this theory. Doubtless the Australian continent once extended seaward to the present margin of the Barrier and, if so, the lost fringe probably carried a normal proportion of river channels. But the remodeling of the coast has completely obliterated these rivers; the present passages through the reef are merely a continuation of the lagoon floor that has not been built over. Soundings do not carry any trench across the reef,

and the existing rivers have no relation to the passages through the reef.

Between the outer Barrier and the mainland lies the Lagoon Channel referred to above; this is the narrow waterway used by the coastwise shipping. Tropical Queensland rises from the sea in steep forest-clad hills. The heavy rainfall of the latitude is shed by numerous streams. Their muddy water is injurious to the coral polyps and so a zone along the land is maintained comparatively free of coral, to the comfort of the sailor. Between the mud zone and the outer Barrier is an area of clear water of from twenty to fifty fathoms deep, overgrown by a most intricate maze of coral patches, various in size, shape, and spacing. The term Great Barrier is apt to be misunderstood, suggesting, as it does, a compact continuous structure running without interruption like the Great Wall of China. The reef, or as one writer would call it, the reeferies, is really

composed, as was indicated above, of an infinite number of separate banks and shoals of coral.

Some of these have an interesting bearing on the theory of atoll structure. No marvel reported by early explorers fascinated the northerners in the homeland as did the tale of the atoll. Picture a hollow island, a lake surrounded with a coral ring, on which grows a forest of palms,—“a garland thrown upon the waters,” as Dana prettily expressed it. The origin of the atoll was a prize puzzle for scientists. Darwin wrote one of his first books about it, and dreamed of a volcanic peak sinking under the sea, while a crown of coral grew upwards till only the coral tombstone was left to show where the drowned peak lay. Sir John Murray assumed that originally there was an island of solid coral, the center of which had been hollowed out by the solvent action of water upon lime.

Darwin failed, however, to consider that atolls are confined not only to warm seas but to the narrower regions of invariable winds, and to explain why the windward side is normally better developed than the leeward. Murray failed to notice that a solvent which would remove the center of the island would also remove the margin and would even prevent its formation in the first instance.

The inner Barrier displays a long series of miniature atolls in various stages of growth. These models show the course of construction. First a point in the reef grows upward till it breaks the surface of the water, then the waves pack round it a mass of drift stones and sand, and the islet so formed assumes a crescent shape with the back to windward and the horns to leeward. The waves continue to sweep along further drift matter and

the crescent thus grows first into a horseshoe and ultimately into an oval, thus enclosing a lagoon. If the process of evolution is continued, the lagoon is filled up and the atoll becomes a solid cay. Finally, seeds drift ashore and a forest clothes the new island.

These coral islands can be distinguished as far as the eye can see, because they are always low and flat. Far away they seem like a black horizontal line. Nearer, they appear like bushes afloat on a raft.

All these great and complicated coral structures are the work of small and feeble animals. It is a popular mistake to assume that the reef is the result of coördinated design by the coral-builders much as a honeycomb is the result of coöperative work by bees. But coral polyps are mere animated lumps of jelly and deposit coral as unconsciously as other animals make bone. A branch of dry coral is pitted all over with small cells; each is the cast of the body of the polyp which sat there when the coral was alive. A skin went from polyp to polyp so that though each individual had a separate life, all were of one flesh. The living polyp has a circle of waving arms set round somewhat like the petals of a flower, with a mouth in the disk. As animalculæ float past, the polyp darts little poison javelins at them. The paralyzed victim is then seized by the petal arms, pushed to the central mouth, and swallowed whole. Only when the tide is very low are the beds of living coral laid bare. Then a wonderful spectacle is displayed, like a garden in which the plants have been turned to stone but where the soft background of foliage is absent. Sea-weeds are so small and scarce that in a general view they are unseen. The coral masses assume the aspect of

gigantic mushrooms, of elegant vases, of flowing draperies, of stalactites and stalagmites, or of tufts of heather. A general tone of brown and yellow is brightened by a few vivid patches of blue, orange, pink, or purple.

Among the coral is strewn an endless variety of animal life, some forms being quaintly shaped and richly colored. Conspicuous for their great bulk are the giant clams, two, or even three, feet across. Gaping wide, these display a myriad eyes like gold-green beads on the brown velvet mantle. There are stories of luckless divers drowned because a hand or a foot was caught in a clam shell. Other smaller clams burrow deep into the stone, till only the grinning "jaws" are seen.

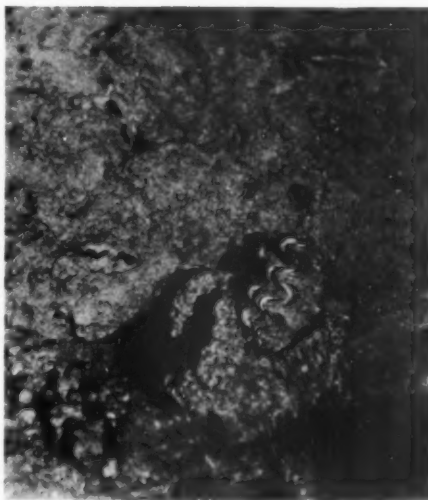
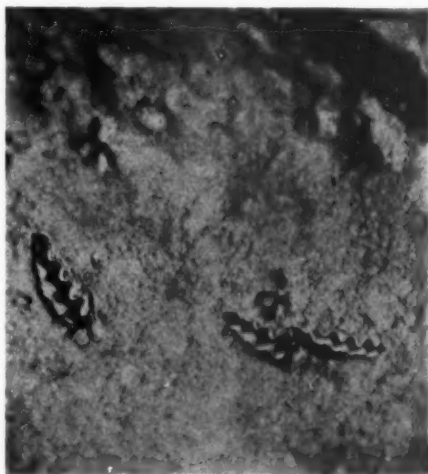
Lying in shallow pools there are black sea urchins with sharp poisonous spines as long and slender as knitting needles. There are starfish of many forms, the commonest being a sky-blue *Linckia*. Some have long snakelike arms which writhe about and which at a human touch are broken and thrown off till dismemberment is complete.

A great sea anemone, the size of a dinner plate, shelters a small fish which is a brilliant scarlet with a vertical white stripe. Any ordinary fish would be severely stung or even killed by the sea anemone, but the scarlet fish is immune and when danger threatens, darts to the bosom of its host and nestles with perfect safety in the midst of poisonous tentacles. Other anemones similarly shelter little prawns.

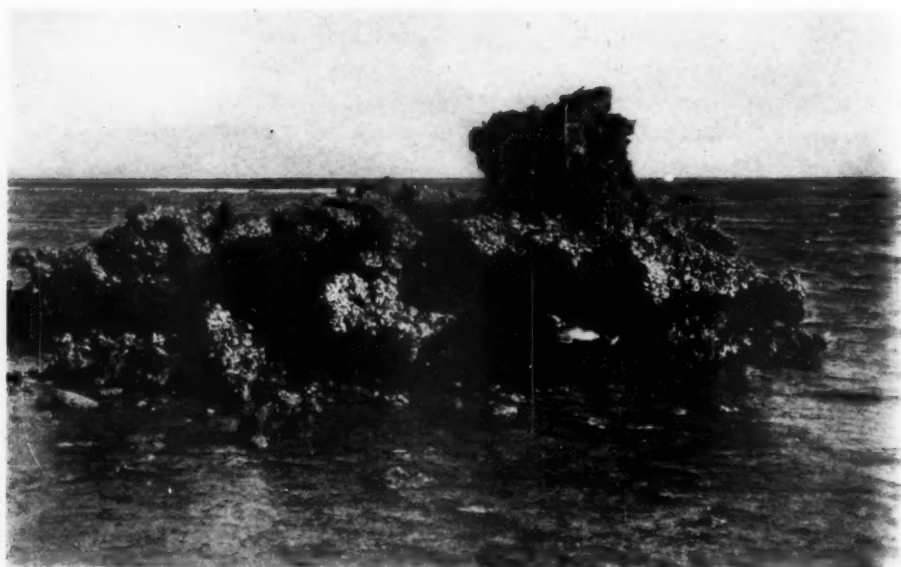
In the shallow pools or buried in the sand are many kinds of *Holothuria*, locally called *bêche de mer*. In shape like a great sausage, in color black, brown, or yellow, they extend a circle of feelers and mop up sand and weed, which is swallowed indiscriminately on

the chance that it may contain some food. These animals are boiled, peeled, dried, and exported in great quantities to China, where a palatable soup is made from them.

Such fields of coral as are described above are seen only at low spring tides. That part which is uncovered during ordinary tides is not beautiful at all, for it consists solely of piles of dead



In the upper picture is shown the clam, *Tridacna crocea*, sunk its full depth in the coral. The exposed mollusk appears in the lower picture



A much worn "nigger-head," or block tossed up by a hurricane



Beach of one of the Howick Islands; about 14° S. This is a characteristic scene on a coral cay. In the background is a low forest of mangroves and other growth; in the foreground is the coral-sand-rock, formed by solution and redeposition of lime under a cover of coral sand

and broken coral and drifts of sand. Here and there along the crest of the reef are blocks of coral blackened and weather-worn, ranging from the size of a table to that of a cottage, that have been torn from the living reef and flung up by a hurricane. Locally these are called "nigger heads." Viewed from a distance as one sails past a reef, they stand out sharply against the sky.

A coral reef is not exclusively a mass of coral. The coral may be regarded as a framework in which are packed the remains of all sorts of animals and plants. Every storm tears off masses of coral and grinds them to shingle and sand. These are swept together and transformed into beach rock by percolation, solution, and redeposition of lime.

In contrast to the low coral islands are the high islands which are stationed between the reefs and the mainland like sentinels along the coast. Sometimes they stand alone but often they are clustered in groups or extend along avenues. Rarely does a voyager lose sight of one before the next appears. They represent the peaks of a drowned coast range. In a late geologic period the former coast was inundated by the sea, and as the Barrier Reef commenced to form, these peaks were isolated. These high islands afford enchanting scenery: they are often several miles long and may rise to more than a thousand feet; they are watered by brooks and clad with dense forests of palm and vine. Their bays and sandy beaches are pleasure grounds beyond compare.

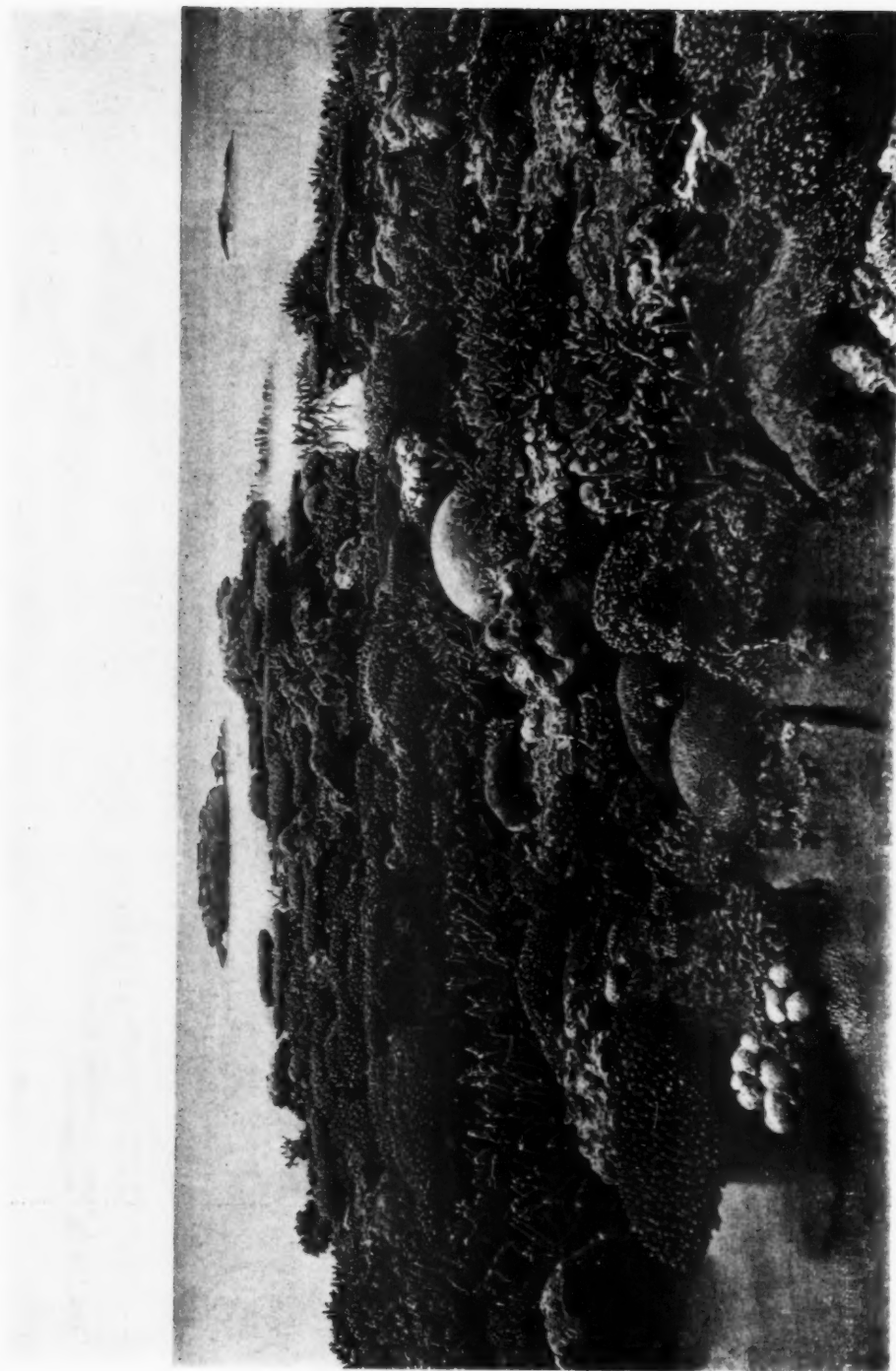
The wide expanse of shallow, warm, and sheltered water included within the Barrier Reef and Torres Strait offers a field for several tropical prod-

ucts. An important pearl fishery is based on the giant pearl shell (*Pinctada maxima*), which may reach a diameter of a foot. Though numerous and valuable pearls are obtained, the industry's chief source of revenue is the shell. This is exported in large quantities and is manufactured into knife handles and other articles of use



A beach with a *Pandanus* tree.—The line of surf in the distance marks the reef at the edge of the lagoon

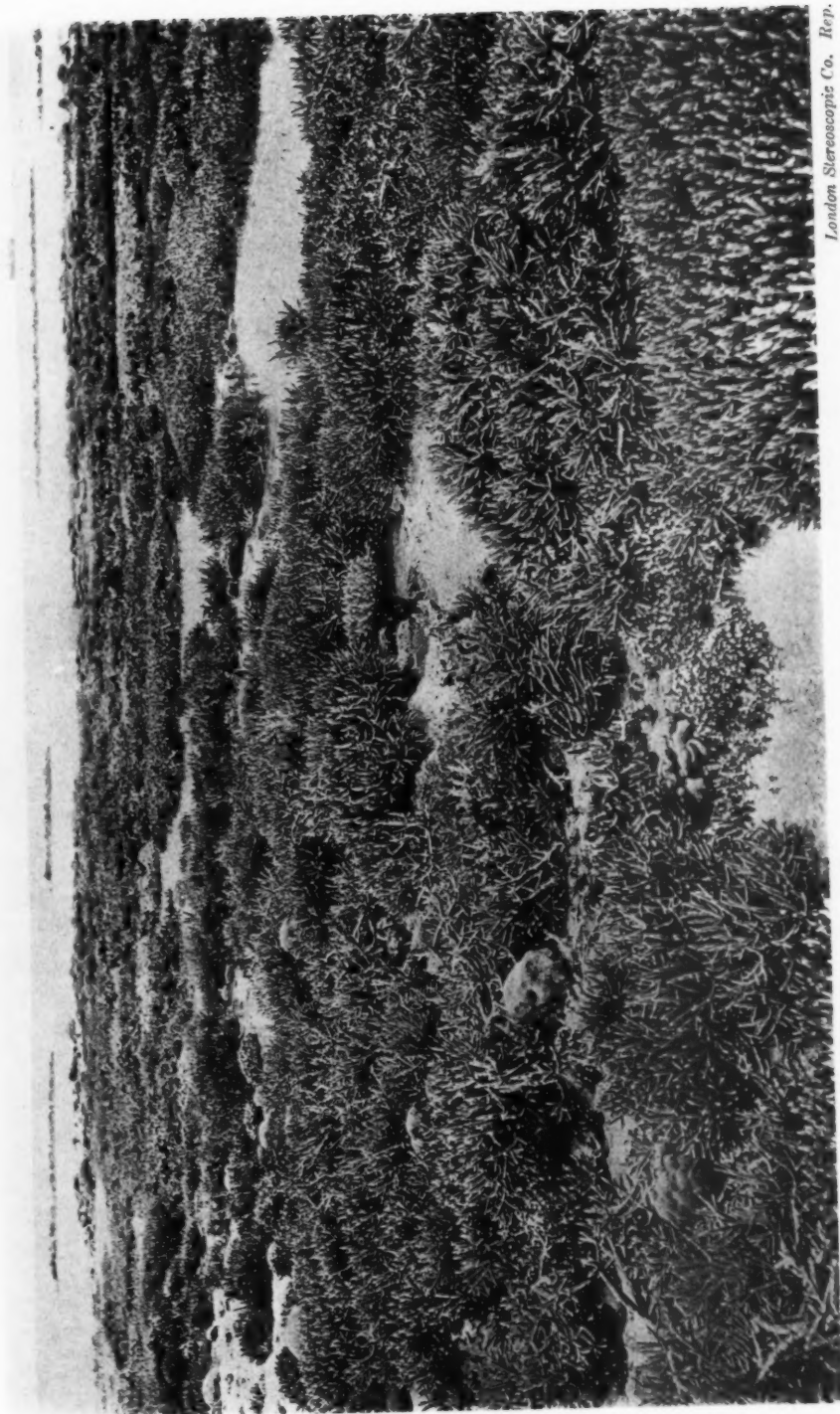
or ornament. The fishery is conducted by a large fleet of luggers manned chiefly by Japanese. The diver, fitted with dress and diving helmet, descends in several fathoms of water, and as air is pumped down to him, he walks along the bed of the sea and gathers the pearl shells in a bag. Another industry is based on the *Trochus* shell, a large gastropod striped with white and red, and nacreous within. This is exported to Japan, and cut by machinery into buttons.



W. Saville-Kent, Photo.

CRESSENT REEF

London Stereoscopic Co., Rep.

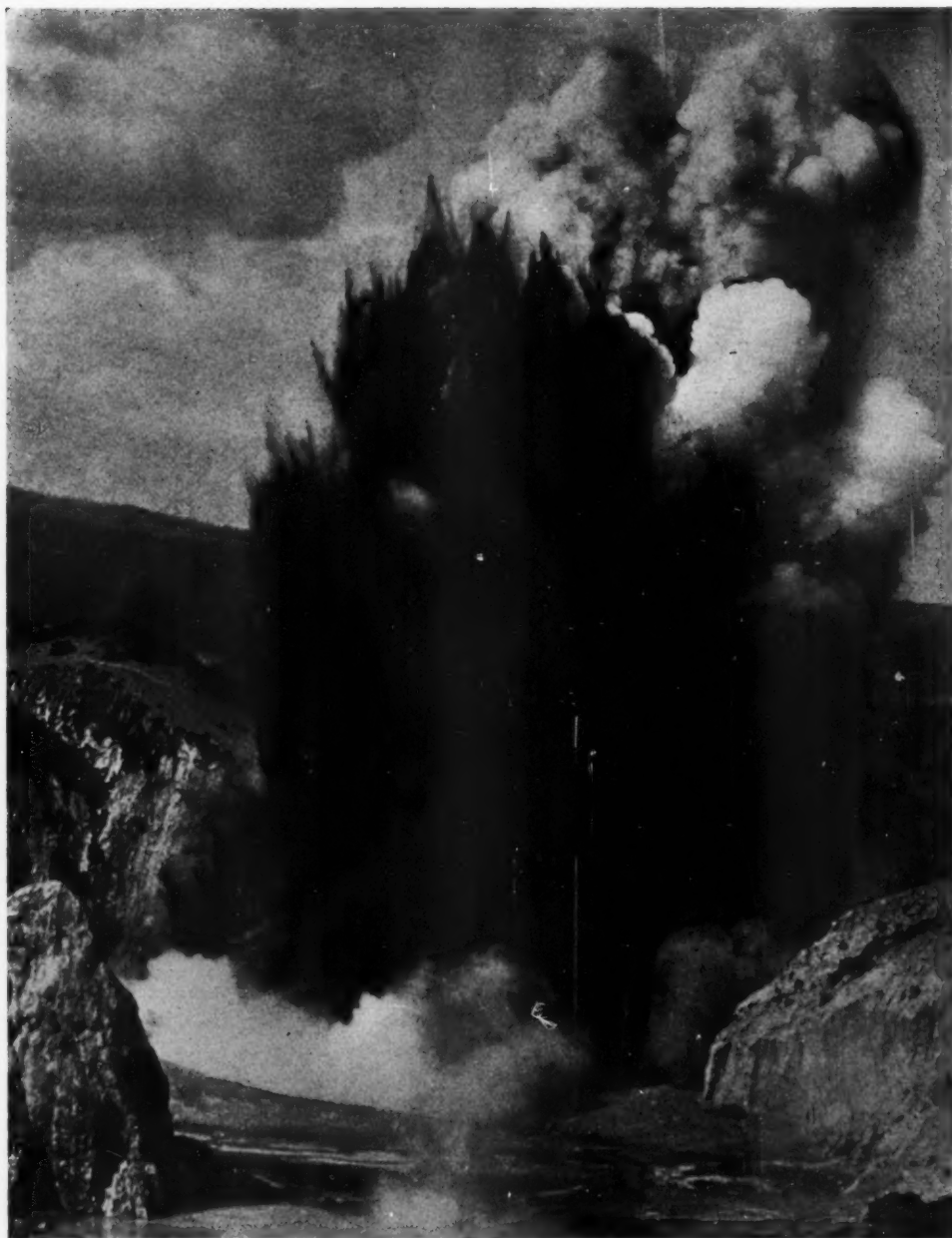


W. Saville-Kent, Photo.

STAG'S-HORN REEF

This picture and the one on the opposing page have been reproduced from W. Saville-Kent's sumptuous volume, *The Great Barrier Reef of Australia*, published by W. H. Allen & Co., Limited, 13, Waterloo Place, S. W., London. They form a part of the beautiful series of photographs of coral growths that embellish that work

London Stereoscopic Co., Rep.



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WAIMANGU GEYSER

For thirty years this geyser, which opened on the eruption rift after the outburst of Tarawera volcano in 1886, was the largest in the world. Its column of muddy water was thrown upward at irregular intervals to heights varying from 900 to 1500 feet. It ceased erupting after Frying Pan Flat blew up in 1917, and a pool of boiling water spread over the area formerly occupied by the Flat. This pool is presumably a safety valve, preventing the eruption of the geyser

Rotorua and the Geyser Region of New Zealand

By EDMUND OTIS HOVEY

Curator of Geology and Invertebrate Paleontology, American Museum

NEW ZEALAND is a land of natural wonders. Crowded into the 103,000 square miles of area comprising the North and South islands are many of the scenic marvels of the world: volcanoes, active and extinct, which are impressive because of their great size or towering height; one of the three famous geyser regions of the earth; beautiful river gorges and cañons, their walls heavily forested to their summits; an Alpine area that rivals Switzerland with its lofty, snow-clad peaks and its great glaciers; a lake region that is surpassing in its loveliness; a series of somber fjords that rival those of Norway and Greenland for depth, grandeur, and picturesque scenery. And all this is set in a framework of pastoral and agricultural beauty that is entrancing to the eye of the beholder in the vision it gives of fertility, prosperity, and peace.

A large part of the North Island is volcanic in origin, numberless cones and craters dotting the land, which is composed of great sheets of lava, scoriae, pumice, and ash. The Auckland district alone contains at least sixty-five old vents, many of which still preserve their craters intact, revealing the origin of the mountains even to the layman. The volcanic activity began in Miocene time and is still manifest in reduced form. Severe explosive eruptions have taken place at Tarawera in 1886 and at Ngauruhoe in 1907, with a small outbreak at the latter place in 1923, but no streams of lava have issued from any of the New Zealand volcanoes since the islands have been known to white men or

within the traditionary periods of the Maori, that is to say, for the past six hundred years.

The great thermal district of the Dominion lies almost in the center of the North Island, extending in a zone some twenty miles wide for 150 miles northeastward from Mt. Ruapehu, a dormant volcano more than 9000 feet high, nearly to the seacoast at the Bay of Plenty. White Island along the same line in the bay is a volcano in the solfataric stage. Much of the zone is an elevated plateau lying from 1000 to 1500 feet above the sea, over which are scattered thousands of steam vents, thermal springs, geysers, and mud springs, visible evidence of the close proximity of the earth's internal heat. Rotorua, a resort with a population of about three thousand, is the center from which tourists usually visit the region or where they stay for longer or shorter periods to take the numerous hot mineral baths and to drink the medicinal waters. The village lies upon the borders of one of New Zealand's most beautiful lakes, from which it derives its name, and is close to the old Maori settlement of Whakarewarewa, more commonly known to the English residents of Rotorua as Whaka. The Maori, a people of Polynesian origin, have occupied this region for generations, covering a period the beginning of which long antedates the advent of the white man, and have utilized the springs for bathing and the steam vents for cooking their food as well as for warmth in winter.

Ohinemutu, also on the lake and immediately west of the village of



Photograph by E. O. Horey

The Maori Church of England edifice at Ohinemutu, with the parish houses adjoining.— The boiling spring that steams in front of the church had not made its appearance when the site for the church was chosen; it is indicative of the unstable conditions in the geyser region



Photograph by E. O. Horey

A Maori whare, or community dwelling, built in the old style, but of materials procured from the white man. Native carvings adorn the front, the posts, and the rafters

Rotorua, is the original Maori settlement of the region. It is built on land which abounds in hot springs, new ones breaking out from time to time to offset old ones that have ceased their activity. A native mission church was built on a point jutting out into the lake, and later a strong boiling spring burst into life in the road in front of the building, obscuring the view with a steam column that seems incongruous in such a setting.

Lake Rotorua lies 915 feet above sea level and though it is one of the larger lakes of the Dominion, it is also one of the shallowest, being but 84 feet deep. Low environing mountains give a lovely setting to the lake and nearly in its center rises the sacred island of Mokoia. On Mokoia were celebrated the great ceremonies of the Arawa tribe of the Maori; there, too, was situated a stronghold often besieged in the frequent tribal wars, and it was the scene of many a cannibal feast. A pleasing legend attaching to the island is that it was the place to which the Maori princess Hinemoa swam from the mainland when her parents refused their sanction to her union with her royal suitor Tutanekai. Exhausted by her long swim, she sought recuperation in a hot pool on the island and there was discovered by a slave of her lover, who summoned him to the rescue. Marriage soon followed and many of the inhabitants of Ohinemutu claim to be the descendants of the happy couple. Visitors are now taken to the famous bath on their tour of the lake.

One rainy afternoon we strayed over to Whakarewarewa, and crossing a primitive wooden bridge, found ourselves in the midst of a native reservation, one and one-half miles from town. It was as if we were in another world. We were immediately approached by a

Maori woman, who collected a shilling from each of us as an entrance fee to the Maori village which lies below the geyser region. The houses in this settlement are not at all native in construction, being built in rough fashion from sawn boards obtained from the white man. Here, however, the Maori live in somewhat their primitive manner and carry on carving in wood and stone and weaving in grass and fiber.

Soon there came up to us Georgina, a handsome middle-aged Maori woman with iron-gray hair, the tattooed lips and chin of a married woman, and a pleasantly modulated voice denoting refinement. Georgina is one of the official guides to the geyser region, which is a government reservation, and she has many Maori legends and myths to relate. She showed us the green-stone tiki, or family talisman, which she wore suspended from a cord about her neck. The tiki is greatly prized and the longer it has been in the family, the more highly is it valued; but the Maori is canny and will part with his tiki for a sufficient consideration. Georgina offered us hers for thirty shillings.

We were shown the village bathtubs—the hot pools—where native boys and girls love to dive for coppers and sixpenny bits thrown into the steaming water. All the Maori love bathing. An innocent-looking pool with conical walls and waters of clear aquamarine hue was pointed out to us as the place where Georgina's uncle had met a tragic end. Returning to the village late one night, he had stumbled into the spring, which lay along the path-way to his house, and had been cooked to death before help could reach him. Since the occurrence of the accident an iron railing has been built around



Photograph by E. O. Hovey

General view of a portion of the composite sinter mound and terraces built up by the geysers at Whakarewarewa, near Rotorua



Photograph by E. O. Hovey

The vent of the great Wairoa Geyser, which at intervals of about twenty-four hours spurts up a column of boiling water to a height of 80 or 90 feet



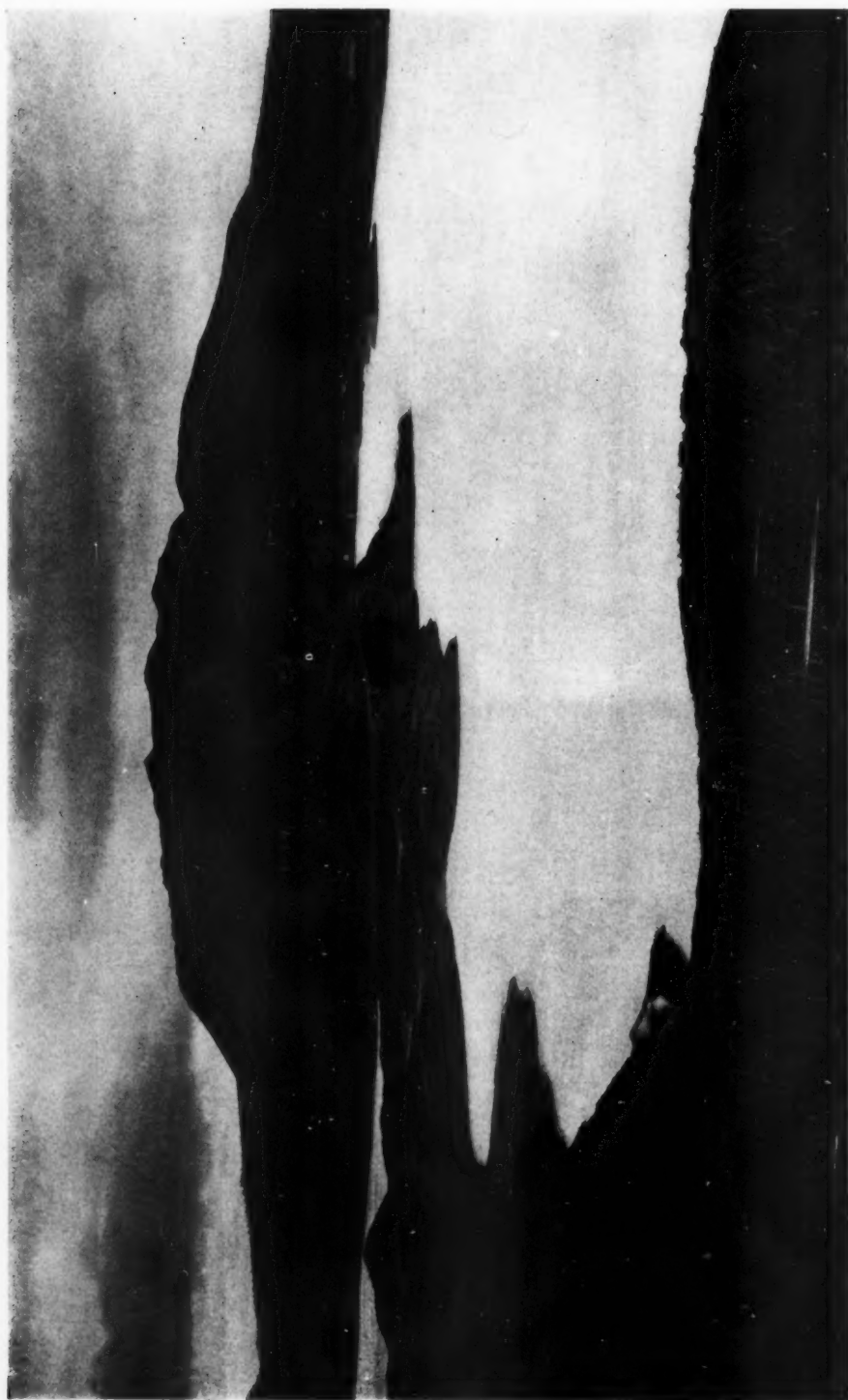
Photograph by E. O. Hovey

The cone of the Prince of Wales Geyser at Whakarewarewa, with a cauldron of violently boiling water below it



Photograph by E. O. Hovey

The Devil's Cauldron, a strongly active "paint pot" about 20 feet in diameter.—The paint pots, of which there are many at Whakarewarewa, are pools of ebullient mud, formed by decomposition of the rocks through fumarole action. They are well named, for the mud ranges from pure white, through various shades of red and orange, to gray and black



Her Photo

TARAWERA MOUNTAIN AND LAKE ROTOMAHANA

This volcano broke into violent activity on June 11, 1886, obliterating the beautiful Pink and White Terraces shown on pp. 78-9 and leaving other evidences of destruction and desolation

the spring, but it is in sad disrepair. One must be careful as he walks about among these springs and not wander from the beaten paths. The necessity for the exercise of such caution was shockingly brought home to us a few days later through the scalding to death of a young woman visitor who strayed from the recognized routes at Tokaanu, on Lake Taupo, and broke through the crust over a boiling spring.

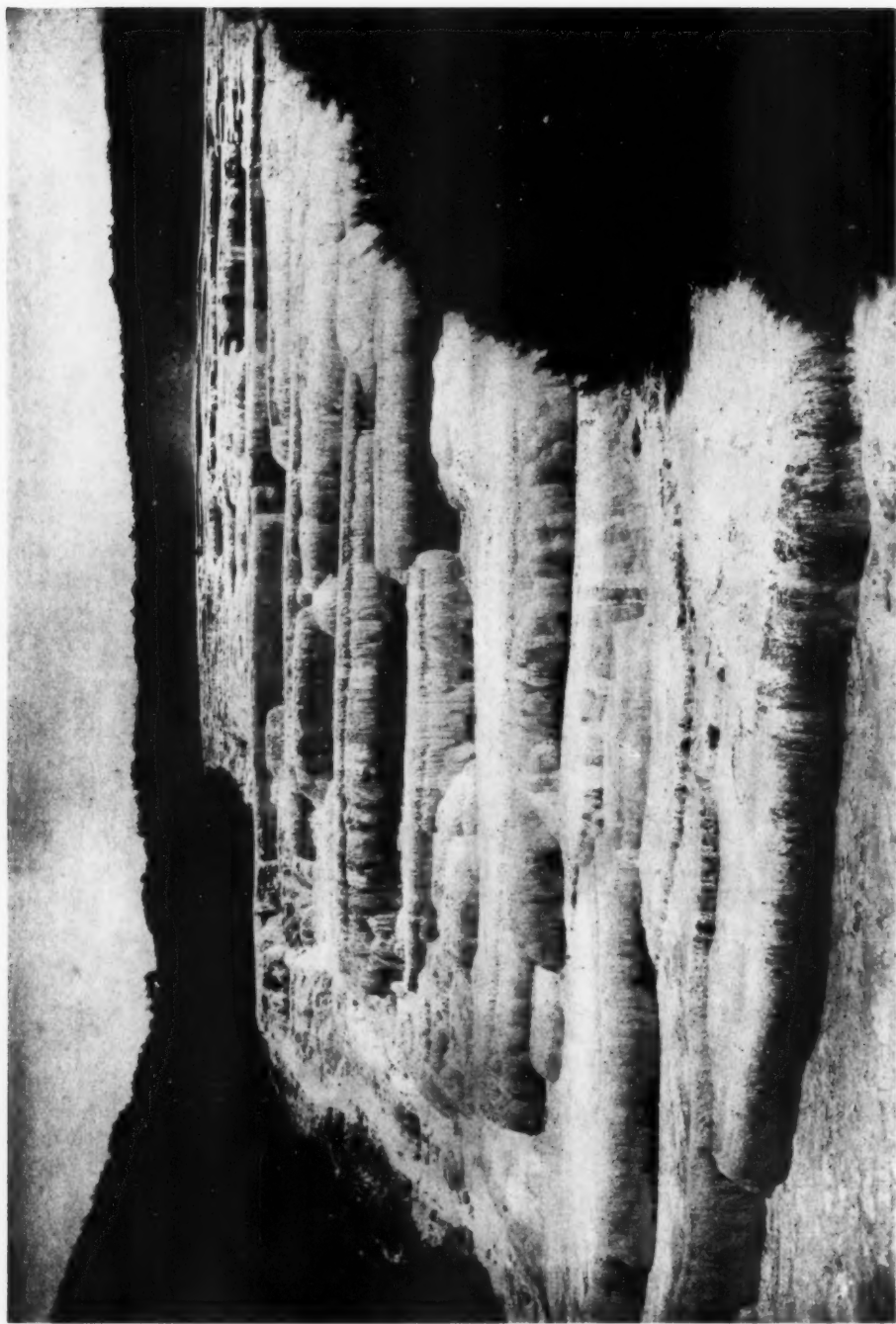
Our guide indicated a little Catholic chapel beneath which a steam vent had opened after construction had begun. Were the Maori builders disturbed by this event? Not at all. They merely fashioned an outlet for the steam beside the chapel and went on with their work.

The government reservation, or park, lies in a shallow valley in the midst of which the geysers have built up a low mound of siliceous sinter a few acres in area. There are many hot springs here, some of which throw boiling, or nearly boiling, water at frequent intervals 10 to 20 feet into the air. About once a day the great Wairoa, or Pohutu, Geyser erupts to a height of 80 or 90 feet, but occasionally it remains quiet for weeks at a time. Just below the throat of the Prince of Wales Geyser lies a cauldron of violently boiling water, which shows well the strength of these springs and gives some hint of the amount of hot water issuing from the ground at Whakarewarewa and swelling the volume of the stream which flows through the native village and empties into Lake Rotorua. It is now considered that the water of these hot springs and geysers is mainly "juvenile" in origin: that is, it was contained in the volcanic rocks when they were in a molten state and has been given off gradually as the lavas have cooled. The water as

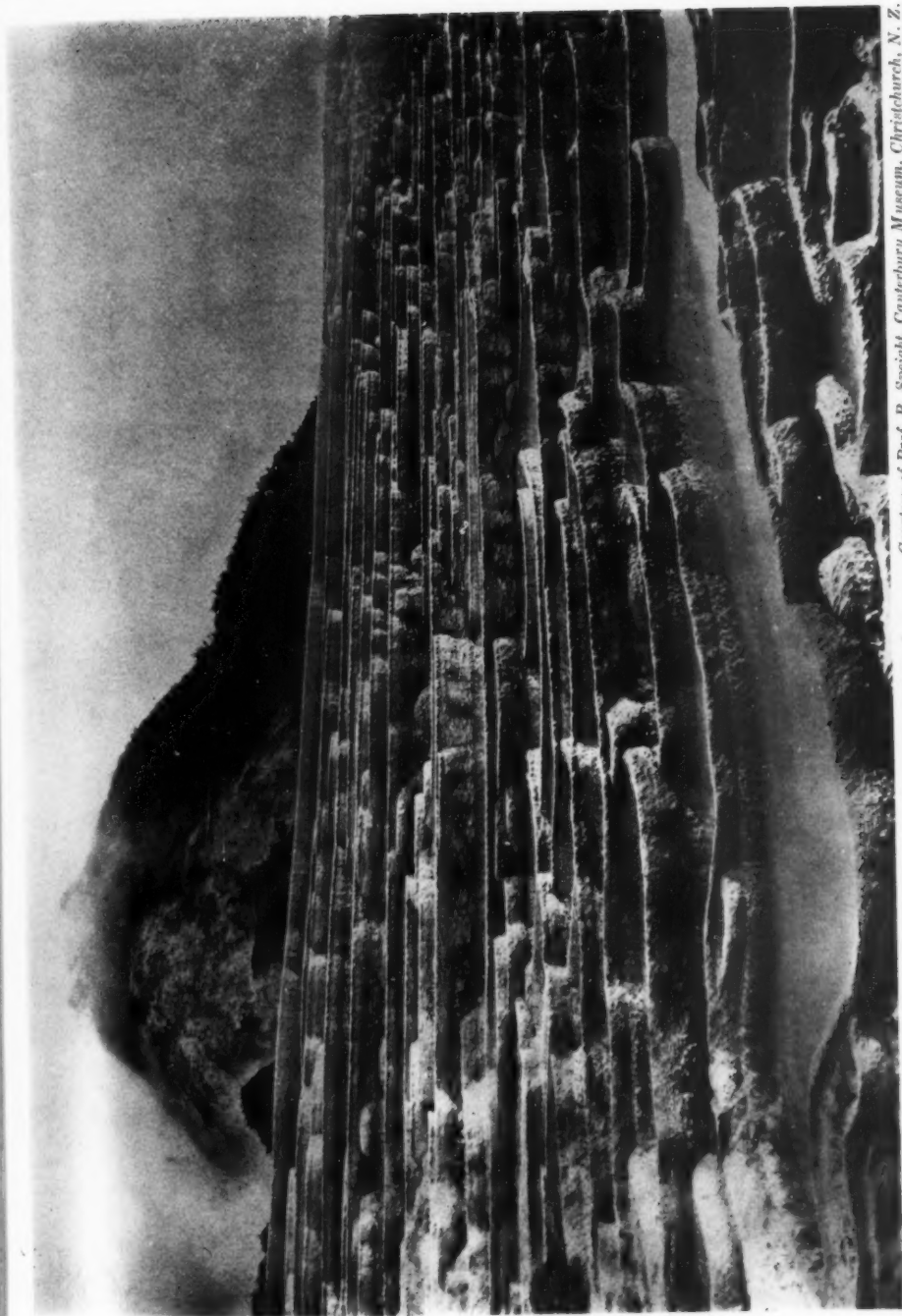
it issues from the ground is, furthermore, highly mineralized and forms deposits not only of the familiar chalcedonic silica—siliceous sinter—which comprises the principal portion of the cones, mounds, and crusts, but also of sulphur, iron oxides, alum, and other minerals. The orifices whence steam alone issues show an abundance of crystals of sulphur in their walls.

The number of paint pots, or mud volcanoes, in the region is large. A paint pot is a place where but little steam issues and only enough hot water rises to saturate the ground thoroughly and make a paste of the rock which has been decomposed by the chemical action of the hot water and steam and reduced to an impalpable powder. It is a phase of fumarole action. The "paint" is pure white or gray, or again, its color may be yellow, orange, or red, due to the presence of small amounts of iron oxide. Some of the paint pots are pools of very liquid mud through which occasionally rises a bubble of steam breaking with a quiet little puff at the surface of the pool, as in gently boiling pea soup. In other pots the mud is so thick and viscous that the pathway, or conduit, of the ascending steam is left open near its top, the mud being thrown out of the way in gobs or splotches, which fall about the conduit and build up a more or less unstable cone. Tikitere, twelve miles northeast of Rotorua, is noted for its craters of boiling mud, while at Waiotapu, thirty miles to the south of Rotorua, near the road to Wairakei and Taupo is a large mud volcano which has built up a cone about twenty feet high with a crater in its top that is sixteen or eighteen feet in diameter.

Perhaps the most interesting excursion to be made from Rotorua is that called the "round trip." It takes one



Courtesy of Prof. R. Spright, Canterbury Museum, Christchurch, N. Z.
THE PINK TERRACES, LAKE ROTOMAHANA



Courtesy of Prof. R. Speight, Canterbury Museum, Christchurch, N. Z.

THE WHITE TERRACES, LAKE ROTOMAHANA

This superb formation, at one time the admiration of all who gazed upon it, was destroyed in the Tarawera eruption of 1886 and the site is today buried beneath a hundred feet or more of volcanic ash. The Pink Terraces (see opposing page) have likewise been obliterated



Photograph by E. O. Hovey

THE CHAMPAGNE POOL

The constant stream of ascending bubbles that burst at the surface suggest the sparkling beverage after which this pool, one of the most interesting in the Geyser Valley of Wairakei, is named. Although usually rising in orderly fashion, sometimes the bubbles ascend in such numbers that their united force lifts the surface water into an effervescing dome one or two feet above the general level of the pool



Photograph by F. G. Radcliffe

THE ORIFICE OF THE DRAGON'S MOUTH GEYSER AT WAIRAKEI

over a route about forty miles long by the Blue Lake of wonderful ultramarine hue, the Green Lake, and a bit of luxuriant "bush," or forest, to the site of Te Wairoa, a Maori village, which was overwhelmed by mud thrown out during the eruption of the volcano Tarawera on June 11, 1886. From Te Wairoa one goes by motor launch across Lake Tarawera, which lies at the west foot of the great volcano of the same name, and over a spur of the mountain to Lake Rotomahana. Here a second launch is boarded that cruises along the shore where the Pink and White Terraces, once the most famous sight in all New Zealand, lie buried beneath one hundred feet or more of ash thrown out during the same great volcanic outburst, and past steaming cliffs, the waters of which make a portion of the lake too hot for bathing and are responsible for the Maori name which it bears, Rotomahana signifying "warm lake." Leaving the lake, the trail ascends the valley in which was the Waimangu Geyser and halts at the Accommodation House, four hundred feet above the lake.

The view from this house, now in ruins, is most interesting. We are standing on the line of the rift which opened in the volcano of Tarawera in the eruption of 1886 and extended southwestward through Lake Rotomahana and Waimangu Valley, out of which were thrown vast quantities of ash and lapilli, covering many square miles of the surrounding country with a thick mantle of débris. It is a scene of desolation, with here and there a patch of green where nature or man has made an effort at reforestation. The hill slopes have been furrowed by the new drainage, which has assumed a dendritic pattern with main channels and branching tributaries. Within a

half mile of our viewpoint lies Frying Pan Flat, now a seething pool twenty-five yards in width, where for years had been an area of dry mud dotted over with small orifices, which were the outlets of hissing steam, giving the whole the appearance of a frying pan on a hot stove. On April 1, 1917, with but little warning the Flat blew up, covering the immediately adjacent hills with mud and wrecking the Accommodation House three hundred feet above it. Its place was taken by a deep pool of actively boiling water, which seems to be the safety valve preventing the eruption of the great Waimangu Geyser. Very near the Flat one sees the dead vent of Waimangu. This geyser had opened on the eruption rift after the outburst of Tarawera and for thirty years was the largest geyser in the world, at irregular intervals throwing a broad column of muddy water to heights varying from 900 to 1500 feet. Its last eruption took place in 1916, overwhelming a guide and two visitors who had ventured to the edge of the orifice for the purpose of taking photographs. Their bodies were found afterward in the stream carrying the overflow from the geyser itself and other hot springs. Beyond the valley we see the lakes Rotomahana and Tarawera with the cone of Mt. Tarawera rising 2500 feet above the lake and deeply cleft by the eruption rift, which left six great craters in the mountain alone.

An automobile ride of fifty miles southward from Rotorua brings one to Wairakei, a center of thermal activity more interesting in some respects than its better-known neighbor. The geyser region is in a little valley a half-mile from the hotel, and is traversed by a small stream fed by hot water from boiling springs in its banks. At least ten of



Photograph by E. O. Hovey

**THE CROW'S NEST GEYSER ON THE BANK OF THE WAIKATO RIVER,
FLOWING OUT OF LAKE TAUPU**

Every four hours a fountain 80 feet high plays from a siliceous cone about 5 feet high and 10 feet in diameter

these springs are true geysers, which throw up fountains of water from 10 to 25 feet high at intervals which at the different vents vary from five to twenty minutes in duration. The Champagne Pool is a spring about twenty feet in diameter, where myriads of small bubbles rise, usually in quiet fashion, suggesting the sparkling beverage for which the pool is named; but occasionally they crowd together and raise an effervescing dome of water one or two feet above the general level.

The Prince of Wales Feathers is the name given to a small vent at Wairakei which well illustrates the principle upon which all geysers work. Ordinarily the balance of forces is such that the outflow of the spring is underneath the silica cone, but when action is desired, the guide puts a temporary dam into a little stream which trickles down the bank above the geyser, thus diverting an excess of water into its throat. In about twenty minutes the temperature and pressure in the conduit have risen and an eruption lasting for several minutes is the result. Somewhat the same principle animates the familiar percolator coffee pot, and we thus have an artificial geyser in action on the breakfast table every morning.

Paint pots abound in the valley, while in several places the overflow from the hot siliceous springs has produced beautiful terraces. The content of silica in solution in the water is considerable and builds up fantastic forms while constructing the cone about the vent of a geyser. At the Dragon's Mouth Geyser a toothlike stalagmite of siliceous sinter projects in weird fashion part way across the mouth of the conduit, receiving constant accretions through deposits from the erupting water.

The banks of the stream flowing through the valley are coated with silica near the vents, and bits of wood immersed therein are soon coated with stone. The dead branches of trees assembled around the orifice of the Eagle's Nest Geyser have been hardened with a deposit of the same mineral. Petrification is going forward before one's eyes.

One of the most peculiar sights at Wairakei is the Blow Hole, two miles from the hotel. Here, in the side of the valley, there is an opening about one foot in diameter from which live steam issues with a noise like that made by steam escaping from the safety valve of a locomotive. The guide states that the steam exerts a pressure of eighty pounds to the square inch. This may well be doubted, but it is difficult to hold a bush in place in front of the vent. The visit to the locality is usually made at night and a weird effect is produced by igniting a kerosene-soaked cloth and allowing the smoke, and finally the sparks, from the burning mass to mingle with the steam. Strange fire works, indeed! A similar blow hole is in the northern flank of the volcano Tongariro, forty miles to the southwest.

It cannot be said that the geyser region of New Zealand equals in attractiveness that of the Yellowstone Park. The lofty mountains which characterize the American region are lacking in New Zealand, and the geysers, while more frequent in their activity, are far less important in the volume of water erupted and the heights to which it is thrown. There are, however, more paint pots in the Rotorua-Wairakei district than in the Yellowstone. The New Zealand region is well worth study by geologists and a visit by tourists.



Photograph by C. G. Kaadt

The North pueblo of Taos, an ancient fortress of the Taos Indians

Some Plays and Dances of the Taos Indians

By FLORENCE MERRIAM BAILEY

THE famous pueblo of Taos, well called the Queen of the Pueblos, stands at the foot of noble peaks in northern New Mexico. The pueblo consists of two great clusters of terraced houses with their associated smaller buildings, one architectural group lying a little way to the north, the other somewhat to the south of the Rio de Taos that flows between. With the general form of the pueblo we were familiar, as are most travelers who have crossed New Mexico, but when we first looked upon it, the height and breadth of its many-storied piles—historic precursors of our modern apartments—filled us with astonishment. Against the dark-brown background of the adobe walls, which, like the neutral monotints used for backgrounds in halls of statuary and painting, gave strong relief for statuesque figures and living pictures, gorgeously blanketed

natives in flaming scarlet or vivid blue were climbing the ladders from story to story or walking about on the housetops in all the splendor of their old-time costumes. What color! What a setting! We seemed to be looking at a scene on the stage, representing the days before the intrusion of the white man.

The first glimpse was enough to arouse the keenest enthusiasm but our interest was further fired by an artist, one of the pioneers of the well-known colony that has established itself in the neighboring hamlet of Taos. He told us of some of the plays and dances he had witnessed. On going over to the pueblo one day, he happened on one of the comedies. A large group of men stood on the housetop. Climbing the ladders to join them, he saw that they were looking eagerly toward the mountains where a band of Taos Indians

dressed like Pawnees could be seen scouting along from rock to rock. They came on until they reached the pueblo, when they proceeded to climb up the walls. The men on the roof went forward to greet them and shake hands with them, but the "Pawnees,"



Photograph by A. E. Weller

Taos men in native costume.—Eagle Star, wearing the bone breastplate, is straightening an arrow

as if suspecting treachery, came up timidly, some shrinking back as they shook hands, others standing, sullenly refusing to shake hands, while still others remained on guard with arrows in bows ready to shoot. When all of the visiting band had reached the housetop, one of the Taos headmen stepped out and announced in a loud voice that the Pawnees had come and that they had brought with them goods taken from palefaces—meaning soldiers and those traveling in the overland wagon trains—which goods they would

now trade for bread. At this the visitors brought out a supply of trinkets which they had collected and the Pueblo women came up with great baskets loaded with bread, which they had been busy baking for days in preparation for this comedy.

We were fortunate enough to witness the symbolic sunset dance, called by the Indians the Foot-racing Dance, as it is preliminary to the religious relay race of San Geronimo's Day. When we reached the plaza, the afternoon light was already on the north pueblo warming its brown walls and lighting up a doorway in which was seated a young Indian girl in a soft, dull-blue dress, a picture for a painter. When we looked over to the south pueblo, on the very topmost roof there stood two splendid figures, a girl in flaming red and a man in vivid green. The Indians below were busy finishing their tasks, and while we were watching them, our attention was arrested by the loud heraldic voice of a tall stately man who walked back and forth on the top of the south pueblo admonishing the people in their own tongue to leave their work and prepare for the vesper service which was to precede the dance. Raising our field glasses we saw the red paint on his face and the red stripe down his toga-like blanket, and caught the glint of the large silver earrings which showed him to be a member of the Big-earring Clan. As the herald strode back and forth on the housetop like a Tribune addressing the people, the young girl in red leaned on a brown chimney top, making a splendid lay figure. Soon after this summons from the south pueblo, the lieutenant-governor, a dignified figure in a dark purple blanket, crossed the square. Reaching the north pueblo he mounted the ladders to the housetop and in his

turn called the people to vespers as the other herald had done.

But the priest who was to officiate had not yet arrived; accordingly, utilizing the interval, two young Indians jumped on their horses and sped away on some belated errand; a woman with a baby on her back hurried across the square; and an Indian whom we had seen previously on his threshing floor passed on his way to the underground kiva to finish dressing for the dance, his face being already decorated with red paint and his hair arranged artistically, one slender braid hanging down the middle of his forehead. Small groups of mounted ranchmen gathered near the mission, wagons of sightseers came slowly drifting in, and the mission bells began to ring at intervals.

Finally the priest arrived, the bells rang more clamorously, and an old Indian took his stand by the mission door beating on a buffalo-skin drum. The courtyard filled with a motley assembly of Indians, Mexicans, and white men, prominent among whom stood the tall war chief and the governor in all the dignity of their rich ceremonial robes.

As we entered the dusky interior of the mission, a glow of candlelight in front of the chancel revealed figures of the devout kneeling upon the floor while vespers were being chanted by the choir. When we became accustomed to the dim light, we could see that the choir standing inside the chancel included several Indians whose blankets contrasted strangely with the white vestments worn by the priest and his assistants, while white men in citizens' clothes and the statue of the Virgin added to the picture. During the service a simple-minded man who wandered in beating a drum was quietly

led out by dignified Indian officials, and when an old blind man tried to grope his way out, a young Indian came quickly forward and took him gently by the hand, guiding him through the doorway.

At the close of the vesper service came the short but beautiful, symbolic Foot-racing Dance, the relay race of the following day being the last of a series of foot races which are explained as "a sacrifice to our father the Sun, to help him on his long run, so that he will give us light forever." Two bands of dancers in ceremonial regalia came up from the kivas that are at the north-east end of their respective pueblos and formed in solid rank, each band at the foot of its own wall, presenting splendid masses of color striped by figures in red, white, and yellow, and topped by branches of yellow and green aspens which had that day been brought from high up on the mountain-sides. These branches, we were told, were used by each of the rival sides to signify that their respective representatives in the ceremonial relay race of the following day would sweep their way to victory.

"Ha-yah'-ha-yah'-ha-yah'-ha-yah'," the two bands broke out in high shrill chorus, advancing in converging lines with branches waving and drums beating till they met in the courtyard of the mission, when nothing could be seen above the white walls but the bright swaying aspens.

In coming out of the mission the dancers formed in one compact band of two facing rows, those from the north pueblo on one side, those from the south on the other. Then began the dance, which was merely a slow progression of the whole color mass by short sidewise steps, the movement accompanied by a strange but truly musical Indian chant. From the front

TAOS INDIANS SINGING FOR

A DANCE

Drums, two of which are shown in the photograph, mark the rhythm in ceremonial dances, and the symbolic religious and poetic songs interpret the ceremonial of the dances.

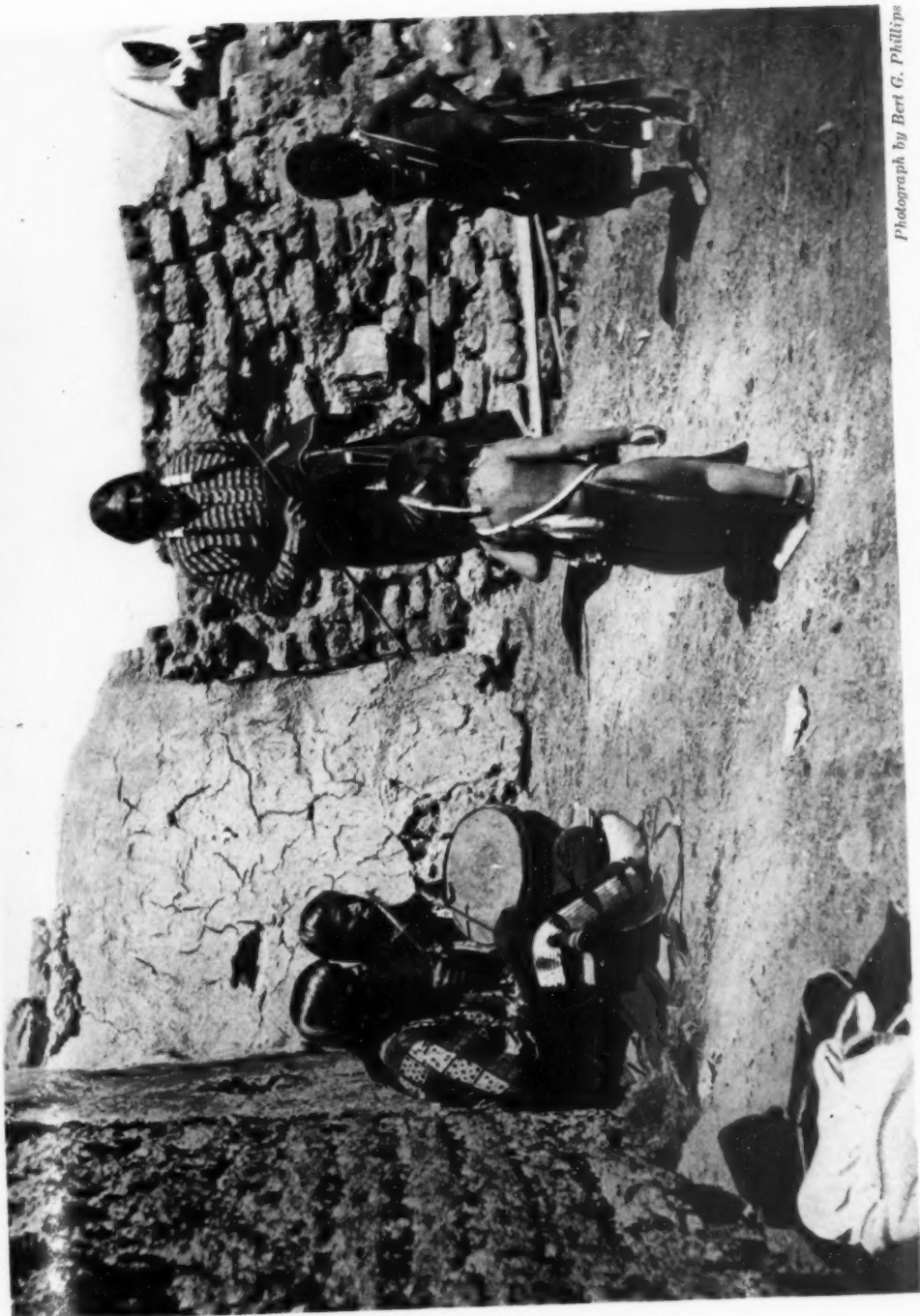
Music, with the Indians, is much more vital than with us: it is an integral part of their lives. Not only every public ceremony, it is said, but "each important act in the career of an individual, has its accompaniment of song . . . fasting and prayer, setting of traps, hunting, courtship, playing of games, facing and defying death," for the voice is supposed to be able to reach the "power that permeates nature and animates all natural forces." (*Handbook of American Indians*. Edited by F. W. Hodge, Vol. I, pp. 958-59.)

Ceremonial songs are "formal appeals to the supernatural." The beating of the high bass drum, once heard as we passed the Taos pueblo at sunset, pulsed through the quiet air with solemn suggestion, for was not the drummer a devout sun-worshiper watching the disappearance of the sun father?

Singularly appealing is the folk music of these children of nature, full of color, of mystery and magic, of poetic suggestion, of sadness, of rejoicing, of dramatic fire. Their heritage it is from the long-distant past, but like all their distinctive Indian life, menaced by the materialistic policy which would deny them religious liberty and mold them in the white man's image



Photograph by Bert G. Phillips



Photograph by Bert G. Phillips

NA-AH-KUN-AH, A TAOS INDIAN, TEACHING HIS BOYS A DANCE



THE WAR DANCE

Photograph by Bert G. Phillips



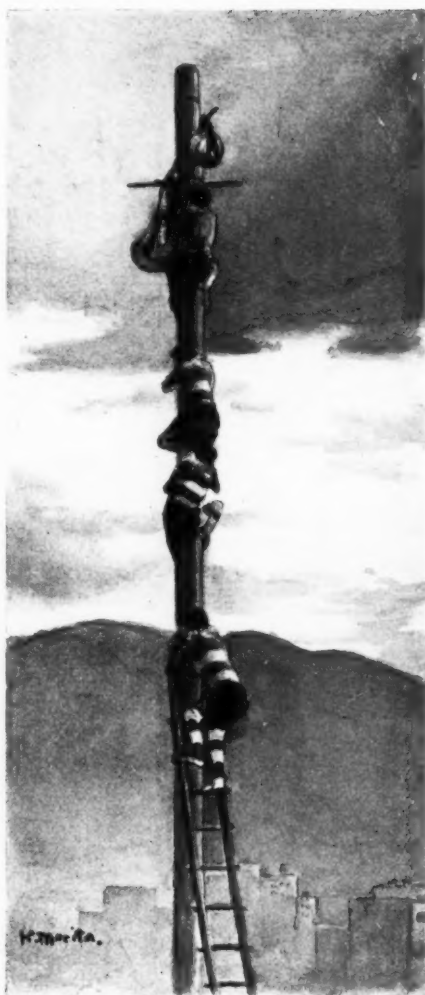
Photograph by Bert G. Phillips

CAREFUL AIM

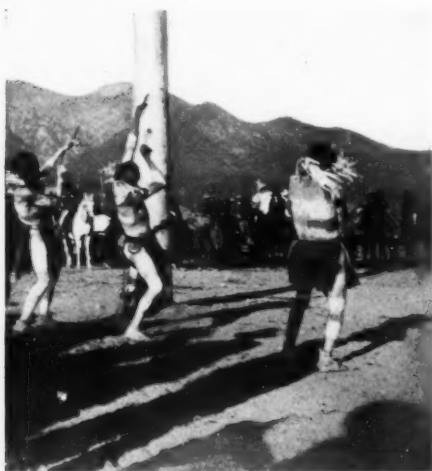
of the north pueblo the column moved slowly across the square to the front of the south pueblo. We watched the beautiful spectacle with intense enjoyment, marveling at the rare æsthetic sense of a people who could originate and find satisfaction in a ceremony of such pure artistic and religious quality.

Another phase of the imaginative endowment of the Taos Indians was illustrated the day after the relay race by a play of humorous character given by the Chifonetti, or Delight Makers. In preparation, a forty-foot pole had been brought from the mountains and set up in the plaza between the two pueblos, and at our arrival a picturesque group of blanketed figures in orange, red, and green, stood at the foot of the pole looking up at an Indian in a red shirt, who was seated on a crossbar near the top arranging the prizes for which the Chifonetti were to climb the pole—a string of watermelons, a great bag of bread with a long red streamer dangling from it, and the whole carcass of a sheep in its wool.

The Chifonetti, with bodies and limbs fantastically banded with black



Climbing the pole to obtain the prizes at the top. Drawn from a photograph



Photograph by Bert G. Phillips

Chifonetti shooting straw arrows at a man climbing the pole

and white, their faces, with their noses as centers, blackened in radiating lines or concentric circles, and their ears decorated with bristling bunches of corn husk, made a bizarre group. At first they went about playing pranks on the people, their fun being taken in great good part by all except one old woman, accidentally hit by a flying apple, who scolded them roundly, much to the amusement of the crowd.

When tired of making sport of the onlookers, one of the Delight Makers

walked up under the pole on which the sheep was hanging and made sheep tracks with his fingers in the dust. Then the acting began. Another of the band strolled by, and, discovering sheep tracks, began trailing the animal eagerly, looking everywhere until, glancing up, the dangling sheep caught his eye. Then with tiny straw bows and arrows the actors began shooting at the sheep with great glee and horse-play. Afterwards, they went through a long performance pretending to climb the pole. When the first man slipped down, they put earth on the shaft, and when he had climbed part way up, the others dropped on all fours, acting the part of furious bulls, pawing, throwing up the earth, and bellowing to discourage the climber's descent. After this they went for a short ladder and one of the group, climbing it, raised his hands in mock dramatic manner toward the sheep and melons beyond his reach. All sorts of clownish play and a running fire of jokes followed, but finally a long ladder was brought and when a chain of men had reached the upper rungs of this and then mounted on each other's shoulders, the top man climbed a few feet and successfully reached the crossbars.

The Pueblo dances, in distinction from the comedies, are, like the Foot-racing Dance, mainly of a serious character,—really not dances at all but, as Bandelier explains, religious ceremonies, with incantation and invocation, the least detail of which has symbolic significance. Even the Buffalo and Deer dances, which were described to us by the artist who witnessed the Pawnee comedy, while having the same dramatic quality as the comedies, were religious ceremonies, performed "as a sacrifice to the game gods." They served for incantation to help

in the hunt, the buffalo song before the hunt being sung "to gentle the herd." This was peculiarly important at Taos, which was one of the pueblos whose warriors for many long generations hunted buffalo on the plains east of the Rocky Mountains. Gray Buffalo, a former war chief, whom we saw, was one of the last of these. Another of the old hunters of whom we were told had kept a valuable and much-sought buffalo robe to be buried in, stoutly refusing all offers for it. Finally, like a patriarch he was carried to his grave wrapped in the great robe, a relic of his own prowess, a relic of the hardy race which he had known and which was gone. In the Buffalo Dance the young men act out what the old men have recounted to them regarding the habits of the animals. The actors, representing a buffalo herd, at one point stop short, swaying their heads from side to side to simulate the grazing of the herd, accompanying the motion with a low munching sound like the cutting of grass with the teeth. After this the big drums beat loudly for the stampeding of the herd.

The Deer Dance, full of charming mythological suggestion, is considered one of the most beautiful of the many Taos dances. The first scene opens with the camp fire of a party of Indian hunters. Then comes the procession of the deer, impersonated by Indians wearing antlers, followed by Indian children dressed in skins of rabbits, foxes, coyotes, wild cats, and owls. Flanking the procession are figures in buffalo skins, representing the spirits that guard the deer herd, to outwit which the hunters carry charms that render them invisible. In the play, when the unsuspecting deer, supposed to be dancing in the woods, are dis-



GRAY BUFFALO

This strong-faced old hunter, with abalone shell earrings, when asked how many buffaloes he had killed, said that he had lost count

covered by the hunters, the guardian spirits try to stampede the herd, and as the animals run, they endeavor to keep between the pursued and their pursuers. Unable to secure a deer, a hunter will run in and snatch a rabbit or coyote, but when he puts it behind his back, the watchful spirit sneaks up and snatches it away.

The necessarily seasonal character of the most important of the Pueblo dances, which has been lightly put aside in the suggestion that the dances be relegated to the winter months, has been carefully explained to me by one of the Taos Indians. As he shows, the specific dates were originally fixed by the Spanish priests who came with the explorers and, finding the Indians with only "their own Indian religion," imparted the Catholic religion to them. With shrewd psychology the old priests told the Indians to celebrate certain appointed saints' days with dances or feasts, as for instance Santa Cruz on the third of May, San Antonio on the thirteenth of June, Santiago on the twenty-fifth of July, Santa Anna on the twenty-sixth of July, San Geronimo on September thirtieth, Christmas on the twenty-fifth of December. While the Mexicans have dropped most of their observances, the Taos Indian says, "We are still celebrating those saints' days."

But in accepting the white man's dates for their dances, the Indians decided to give those which, according to

their own religion, must come at approximately the same dates. As my friend puts it, "When we were forced to do this in those old days, the Indians agreed to celebrate the summer saints' days by dancing Corn Dance. They had to dance Corn Dance anyway. The Spaniards thought it was a dance for pleasure in such hot days, but it is a sacrifice that we do to the rain gods or angels, so that we may get plenty water and rain for our crops, not only for this place but for all over the world for the benefit of every living thing and plants." (Here we see the broad outlook and the generous spirit of the Indians.)

Another important dance, given in late August after the corn dances and also concerned with the crops, is the Blue Lake Dance, "to please the rain gods that are in that big lake."

The Buffalo and Deer dances are given respectively on Christmas and a January saint's day, because before there were restricting game laws, the Indians, having the leisure, hunted in winter. So important is the performance of these various religious dances that, my friend says, "If the Indians of this place, Taos, give up and break the rules of their religion, according to their traditions, they (especially the old people) fear the end of the world will soon come." And he concludes with the touching appeal—"Now I hope you will have a better idea about why the Indians insist to dance those dances."



An eland cow grazing on a termite hill (white ants' nest) with three oxpeckers on its back. Photograph taken near Donya Sabuk, Athi Plains, British East Africa. Courtesy of Monsieur V. Forbin, Paris

The Eland and Its Bird Sentinel

By HERBERT LANG

Assistant Curator, African Mammals, American Museum

OF all the magnificent sights on the East African plains, none can rival in beauty the spectacle of vast herds of game. Antelopes, though less conspicuous individually than giraffes, elephants, rhinoceroses, and zebras, occur there in such numbers and variety that they are among the most impressive of the herds. No other continent offers such suitable conditions for their development. The herds graze, browse, and move about apparently in perfect indifference to any possible danger, confident that the scattered outposts of their number are always on the alert to give the warning signal.

In the accompanying photograph is shown an eland cow that has strayed away from the herd to graze upon the more succulent grass growing upon a termite hill. Engaged in feeding, she

cares little for sentry duty, apparently conscious that no watchdog, however keen, could render her better service than the three tiny birds perched upon her back. These oxpeckers (*Buphagus erythrorhynchus*), which in the picture appear as dark specks, also accompany other game and cattle. Feeding on ticks, they clear their hosts of their tiny tormentors, and also keep watch with an unabated vigilance that can seldom be foiled. Their sharp, shrill, warning notes send the eland off at a gallop, and your chances of coming closer to your quarry are gone. Nothing is gained if you try to follow, for it is a well-known fact that even during their undulating flight high in the air these little sentinels still utter warnings, thereby increasing the speed of their protégés.

The elands are the largest of exist-

ing antelopes. The old, nearly hairless, "blue" bulls, with the dewlap reaching close to the ground, attain the size of an ox; the brownish or rufous females, with their lighter horns, are less heavily built than the males and show the lateral stripes more clearly.

The East African eland here pictured is of the northern race, discovered in 1860 by Speke and Grant, who became famous for clearing up the mystery regarding the Victoria Nyanza and some of its affluents. Not until many years later, in 1902, was this eland named *Taurotragus oryx pattersonianus* by Lydekker in honor of Colonel Patterson, well-known for his fascinating volume, *The Man-Eaters of Tsavo*.

This form ranges from Tanganyika Territory northward through British East Africa to about the Lorian Swamp and Laikipia Plateau, and westward all through Uganda and along the east side of the Nile as far as Mongalla. Eight races of eland are known, extending from South Africa to East Africa, as stated, and westward to Senegambia. Before the rinderpest swept these regions in the nineties, herds of several hundreds of the Patterson eland were recorded on the plains and high plateaus, where in diminished numbers they still graze at an altitude of 8000 feet; but though greatly decimated along their northern range, all reports confirm the fact that in later years they have again increased.

Although often common in dry districts, the elands prefer the country of luxuriant pasturage and on the plains frequently mingle with other antelopes and with zebras. Elands are heavy, cumbersome-looking animals and are not speedy in a long run. The surprise is all the greater, therefore, to see them leap one over another's back apparently as playfully as gazelles. Such leaps are, however, the result of excessive fright due to their being suddenly startled rather than a deliberate exhibition of skill.

During the heat of the day these antelopes frequently rest by lying down in the shade or by standing among the bushes. In regions where zebras are abundant elands suffer little from the depredations of lions, though in certain high plateaus where game is scarcer and where the elands come regularly to the water, their ranks are more frequently depleted.

Although elands are easily tamed, the experiments of different governments have proved that domestication is not practicable. When subjected to confinement in the regions they inhabit, they succumb to various diseases much in the manner of corralled zebras. In European zoölogical gardens, however, elands thrive and reproduce fairly well, having either one or two young; but they cannot be trained to render any useful service, though mildness is one of their chief characteristics.



The turret on the left, housing a colony of termites, was erected by the insects at a distance of about two feet from the concrete foundation of a house. This turret reached a height of $8\frac{1}{2}$ inches. The turret on the right shows that the termites do not exercise very good engineering ability, for in this instance at least they failed to keep the center of gravity over the base of the turret

Turret-building Termites

By R. W. DOANE

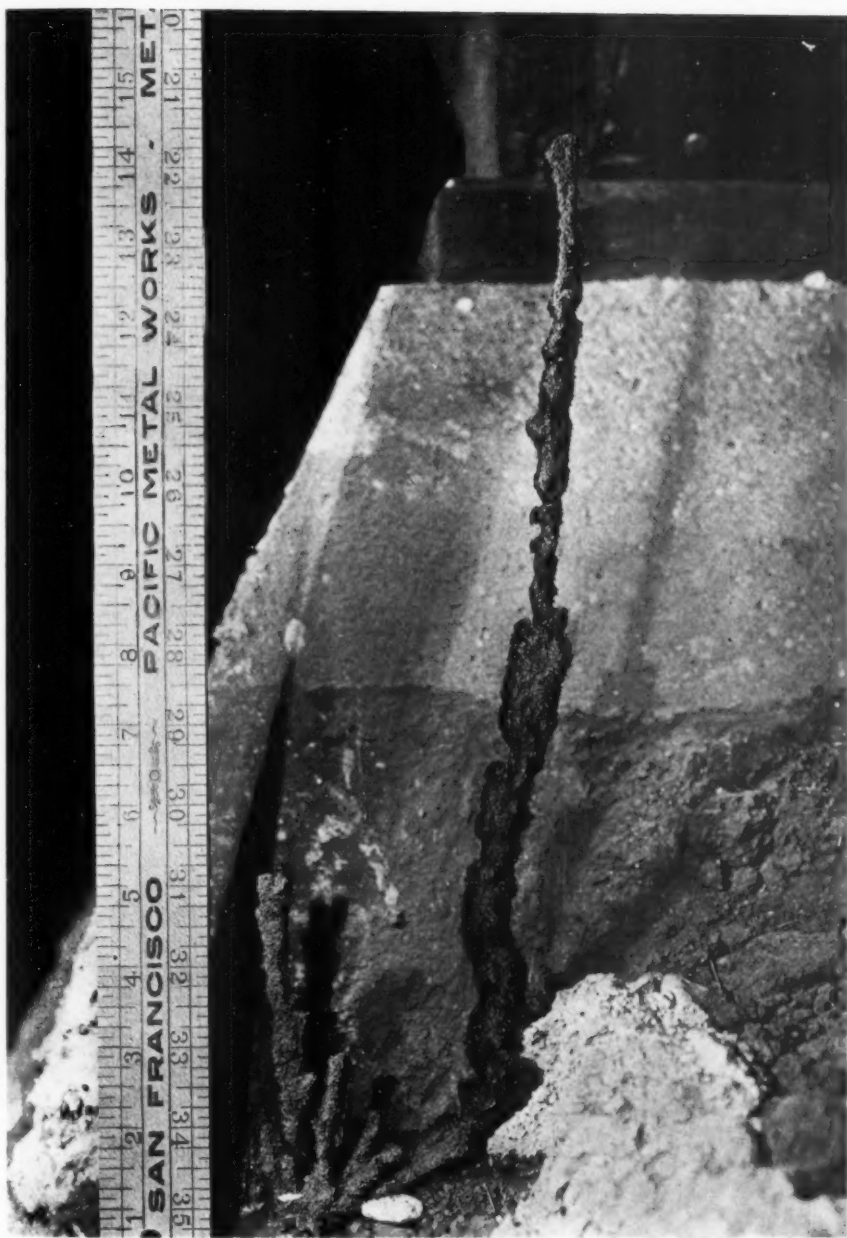
Associate Professor of Entomology, Leland Stanford Jr. University

IN April, 1919, my attention was called to some unusual turrets that were being made by termites in the basement of a house in Palo Alto, California. The first one of these was found rising from a concrete wall that surrounded the lower part of the basement. It was nearly fifteen inches high, the first three inches lying against the beveled base of a concrete pillar,

the rest standing entirely free from the pillar or any other support. Around the base of this turret were other smaller ones rising to a height of from two to five inches.

Later additional groups of these turrets were noticed in other parts of the basement. In one of these groups there were several turrets varying in height from three or four inches to

¹With photographs by the author



AN INSECT SKYSCRAPER

Termites, misleadingly known as white "ants," differ from the true ants in many other respects besides color. Yet like the ants they lead a communal existence, have different castes, and erect structures that may well excite admiration. The large turret shown in the picture reached a height of nearly fifteen inches, the first three inches lying against the beveled base of a concrete pillar, but the terminal twelve standing entirely free

seventeen inches. These rose directly from the ground about two feet away from the concrete foundation of the house.

All of the turrets were very brittle, a slight touch being enough to send them crumbling to the ground. In order that they might be taken to the laboratory for further study, some of them were sprayed with very thin shellac. Only a few could be saved even in this way, however, as the light blast of air from the atomizer that was used for spraying caused most of them to topple over and break into small fragments.

As soon as any part of a turret was broken, a few termites would crawl out and wander about until they could find some crack or crevice in which to hide. Nearly all of these turrets were populated by workers, soldiers, and winged individuals.

Soon after the turrets referred to were observed, some smaller ones were discovered in a greenhouse. When they were first seen, the owner of the greenhouse thought that the children

had been driving sticks in one of the walks between the benches. When he attempted to pull up these "sticks," he was surprised to find them crumbling to pieces and to see the white "ants" crawling out. Some of these structures were about three inches high. Most of them consisted of a slender, upright shaft; others were broader and branched like coral.

A little later three additional colonies were found building low turrets from one half to one inch high in cracks of the sidewalk in the business district of Palo Alto, where the streets have all been paved for many years. These turrets were destroyed every day by people walking over them but they would be rebuilt during the night.

Still another colony was located on the University campus. These turrets were in exposed places and were only one or two inches high. The winged termites were issuing from them.

The termites that built these turrets belong to the species *Reticulitermes hesperus*.



A group of turrets found in a greenhouse



The Public Museum of Staten Island, though small in size, has a distinct sphere of usefulness because of its emphasis on things local. The basement and first story have been built by contributions from 126 citizens of Staten Island; a second and third story are planned but not yet erected

The Public Museum of Staten Island

A TREASURE HOUSE OF LOCAL NATURAL HISTORY, ART, AND ANTIQUITIES

By CHARLES W. LENG

Director of the above-mentioned institution and Research Associate of Coleoptera, American Museum

THE Public Museum of Staten Island, though the smallest of Greater New York's museums, has, viewed from one angle, a broader scope than any of them, for it must combine within itself interests as contrasted as natural history and art, which in larger communities are represented by different institutions. However, a scheme apparently so embracing is made feasible by the fact that the

chief concern is with things pertinent to Staten Island. The arts, industrial and fine, as practised on Staten Island; natural history, botanical and zoölogical, as exemplified on Staten Island; the civic history and antiquities of Staten Island,—these are the prime objects of its collections, researches, and publications. The progress of arts and sciences elsewhere in the world is the subject of many of its lectures and

of occasional comparative exhibits, but Staten Island is its basic endeavor. Its library includes, in addition to standard works for reference purposes, a fine collection of books and pamphlets on Staten Island history, genealogy, and natural history. This policy was of course, not reached completely when the parent association started Novem-

tionary relics have aided the writing of the history of the events of that war in the vicinity of New York; the new species of insects that have been described from the collections of Staten Island entomologists are too many to recount; and Staten Island records of occurrence for both plants and animals are constantly being cited. Thus,



Photograph by William T. Davis

The natural history division of the Public Museum of Staten Island, with the cases of local minerals and birds, and the drawers containing insects, shells, and other material, is well worth visiting

ber 12, 1881, but has been gradually evolved and is now succinctly expressed in the charter.

The intensive study of a limited area produces results that interest many others besides those living within such an area. The discoveries of Indian relics made by local students on Staten Island have been quoted wherever the subject has been treated, and the stone head found in 1884 remains almost unique; the discoveries about the old British forts on Staten Island of revolu-

whether viewed from the practical side, as interesting the people of Staten Island, or from the scientific side, as producing results of value, the policy of restricting the scope of the Museum to Staten Island, but covering that small area in every phase, has proved wise and a prime cause of the Museum's prosperity.

While the pursuance of such a policy, combined with the small amount of space available, has necessitated at times declining objects, especially large

ones, of value, it has also resulted in the acquisition and preparation of some exhibits of importance. Among such are the types of fossil plants described from the Cretaceous beds at Kreischer-ville by Dr. Arthur Hollick, and the great display of fossil amber from the same locality. These have been visited by geologists from many lands. The herbarium contains many historic specimens. Its foundation dates back to the early collecting by Dr. N. L. Britton when many species, since exterminated by fire and vandalism, could still be found. Of terrestrial orchids, for instance, it contains twenty-three species, though it would be hard to find more than three today growing wild on Staten Island. The same is true of the beetle collection, made by Mr. Davis and the writer, containing many species caught forty years ago which certainly could not be duplicated now. The bird collection contains the passenger pigeon and Carolina parakeet that once lived on Staten Island but live there no more. The geological collection contains a mastodon's tooth, dredged from the Arthur Kill in the days when the oyster industry was thriving, and another found at the bottom of a kettle hole in the Middletown forest when the locality in question still deserved the name. These and many other similar specimens give the collection of the Staten Island Museum an historical value that will increase as time goes on. Its treasures include no less than sixty maps of the island beginning with 1610, one year after its discovery by Hudson.

• Among the recently arranged exhibits that appear to be especially useful to visitors is one comprising all the common insects of Staten Island, arranged to show their classification (following that in *Field Book of Insects*

by Dr. Frank E. Lutz, of the American Museum), their metamorphoses, their nest structures, and the benefits which insect friends confer and the injuries which insect enemies inflict upon mankind. Although only about two hundred specimens are used, they have been selected with a view to presenting the principal types in each order. As far as possible comparatively large as well as common forms have been chosen for the purpose, so that the visitor soon feels at home and is led from seeing insects he knows to an appreciation of the relationship of those less known to him, and from that to a knowledge of the immature stages and the work that insects do.

Other exhibits of even greater local interest are three historical groups modeled by Edward J. Burns while a member of the museum staff, showing respectively Indian life on Staten Island three hundred years ago, Indian Wars, and the Billop House Conference.

The museum is a center of activity for numerous local societies with objects akin to its own. Sections of fine arts, history, engineering, and natural science were early formed and are intimately connected with the museum. Twenty-six art loan exhibits have been held at the museum during the last few years as a result of the labors of the section of fine arts; and about five thousand ecclesiastical records and epitaphs have been copied and indexed by the section of history.

The Staten Island Bird Club takes a monthly nature hike for the purpose of observing birds, plants, and insects; the Horticultural Society is interested in growing fine flowers. The Nature Study Club—a collection of "tramps" of all ages and both sexes—exists happily, without by-laws or dues, for the purpose of an informal interchange

of information and enthusiasm over the camp fire or in the museum, with or without coffee, but preferably with. The Children's Museum League, inaugurated by Miss Pollard, of the museum staff, is composed of the children who visit the museum. These children choose their own officers and speakers, and with little guidance from adults, develop a love of nature and the spirit of individual research. Emphasis should be given to the Women's Auxiliary, an influential body which has directed several important exhibits,

as well as superintending the work with children in the museum and the schools.

The membership in the institute supporting the museum and its affiliated societies exceeds six hundred. An additional four hundred individuals are connected with organizations that, while not affiliated, enjoy the museum's hospitality. A monthly *Bulletin* is mailed to all members, notices are sent to schools, libraries, and other special centers, and the local press of Staten Island is kept supplied with items regarding the museum's activities.



Photo by W. T. Davis

This miniature group (actual size $3\frac{1}{2}$ ft. wide by 2 ft. high) was recently completed by Mr. Edward J. Burns.

It represents the early morning of September 16, 1655, when the Dutch settlers on Staten Island, about ninety in number, under the leadership of Capt. Adriaen Post, representative in the colony of Baron Hans van Capelle, were attacked by a large number of Indians. The Indians had been angered by the shooting of a squaw for stealing peaches on Manhattan Island; their assault upon the population of Manhattan had been repulsed on the preceding day, but their attack on Staten Island was so successful that the local settlement was destroyed, a few settlers being killed and about fifty taken prisoners.

The figures in the group are $6\frac{1}{2}$ inches tall, modeled of beeswax and colored with oil paints; the tree trunks are modeled in plaster; the stockade is carved in wood; the cabin is partly wood, partly plaster; the background represents an autumn sunrise over the forest, studied from nature on early September mornings along the water front on Staten Island where the settlement was located.

"Birds of the New York Region"

A REVIEW OF MR. LUDLOW GRISCOM'S RECENTLY PUBLISHED HANDBOOK

By WITMER STONE

Executive Curator, Academy of Natural Sciences of Philadelphia

THERE has recently been published, as one of the Handbook Series of the American Museum of Natural History, an attractive little volume by Ludlow Griscom on the *Birds of the New York Region*. It is intended to take the place of Dr. Frank M. Chapman's pamphlet of similar title published seventeen years ago as a guide to those studying the wild birds of the metropolitan district.

In the nomenclature of ornithological works this volume would, we suppose, be classified as a "local list," but it is far more than that, and differs in many essential particulars from any local list of our acquaintance. In these very points of difference, moreover, it accentuates the marked changes that have taken place in methods of bird study, changes which, while for many years evident in practice, are only just beginning to make themselves apparent in local publications of this kind. So admirably indeed does Mr. Griscom's little book reflect the modern methods that it stands as perhaps our best exponent of what we might term the "new ornithology."

In the annotated list of the last generation a general statement of the character of the occurrence of each species of bird in the district under consideration, with dates and localities of such specimens of the rarer species as had been shot by the author or others, seemed to suffice; and if descriptions were deemed necessary, they were drawn up from specimens and were mainly of value in identifying other specimens which might be collected.

In other words, the keynote to the whole study was the collecting of specimens.

All this has now changed. The necessity—yes, in most cases even the excuse, for collecting no longer exists except in the case of ornithologists working in our larger museums or carrying on original research, and the binocular field glass has taken the place of the gun. We do not mean to intimate that Mr. Griscom is one of those who would not under any circumstances kill a bird, but he realizes that for the great majority of our local bird students collecting is unnecessary. His aim has been to render their work without a gun as free from errors as it is possible to make it, but he believes in collecting specimens when a critical scientific question can be settled in no other way. As a Kentucky mountaineer friend of the writer once said to him in another connection, "This is a perfectly law-abiding country; no man is ever killed here unless he needs killing." However, in spite of the great army of bird students who are studying the live birds, most of our books still follow the old model and minutely describe museum specimens instead of giving us the field marks by which we may most easily recognize the bird in life, and in breaking away from this custom Mr. Griscom's book comes nearer to what the field ornithologist of today needs than anything we have seen. For some years he has been making a special study of field identification, determining just what species can be positively identified from the

living wild bird, and what color markings or other characters in each species are best suited to serve as identification marks.

Such information is what the field-glass ornithologist needs and what *ornithology needs* in order to eliminate errors in sight records, and it is upon sight records that most of our studies of migration, distribution, and similar problems are going to be based. We require a vast amount of data for this work, far more than could ever be secured by collecting specimens, but the observer must be instructed how to identify positively the live birds which he sees. In this book on the birds of the New York region Mr. Griscom has embodied much of the results of his studies along these lines, and the volume becomes therefore of much wider importance than its title would indicate and should really be in the hands of every serious field student of our eastern avifauna.

Another important point in Mr. Griscom's treatment of his subject is that he carefully delimits the country he covers, including only areas with which he or his associates are reasonably familiar, and refrains from making any "blanket" statements supposed to cover a given circle of so many miles radius, in portions of which perhaps the details of bird life are quite unknown to him. We find therefore in his text (1) a general statement of each bird's occurrence on Long Island, which has long been a Mecca for the ornithologists of New York, with more exact data for Orient, Mastic, and Long Beach, three stations where much intensive work has been carried on; (2) statements covering the bird's occurrence in that portion of New York in or just north of the city proper, with detailed ac-

counts for Central Park and the Bronx, favorite resorts of city bird students unable to go farther afield; and (3) a general statement for northern New Jersey, with special details for Englewood, the home of Doctor Chapman and other active bird students. The results of an intensive study of the bird life of a limited field are always more satisfactory than generalizations covering a larger area, as all local students will testify, since each locality has its peculiarities, and when these are known to the bird student, each of his observations takes on an added value. Moreover, Mr. Griscom's method indicates just which areas about New York City are still in need of intensive study—such as Orange, Rockland, and Putnam counties, New York State, and the most northern portion of the New Jersey coast—all included in Doctor Chapman's fifty-mile limit. Doubtless Doctor Chapman's general statements—all that it was possible for him to make at the time his list was published—cover the bird life of these regions fairly well, but now that the fact of their neglect is forcibly brought out, intensive studies will undoubtedly be made there and the detailed results will be most interesting when compared with those given in the present work for the other sections near by.

Considering the bird life of the entire region covered by Mr. Griscom, many persons will doubtless be surprised to learn that no less than 377 species have been recorded as occurring so near to New York City, and that of these only 12 are rated as now extinct in this area and 84 as casual or accidental. California with her immense territory has but 530 kinds of birds, of which 120 are closely related geographic races and a number of others are casual or acci-

dental, so that our eastern avifauna is not so poor after all.

Of several of the localities where intensive study has been carried on, we find that Orient is credited with 283 species, Mastic with 227, and Long Beach with 239, Central Park 186, Bronx 227, and Englewood 232, while on a single day no less than 66 species were seen in the "Ramble" in Central Park. The summary further shows that, of the entire list, there are 37 resident species, 89 summer residents, 6 summer visitants, 30 regular winter visitants, 20 irregular winter visitants, 78 regular transients, 21 irregular transients, 18 casuals, and 66 accidentals, together with the 12 now extinct near New York.

Let us now take up the author's account of one of the familiar species to ascertain just what information the student may obtain from the work. The white-throated sparrow, for example, is not dismissed with the statement that it is an "abundant transient and less common or local winter resident." On the contrary, we find that: "It arrives in the fall with the first decided drop in temperature in September. By the middle of November only the wintering flocks remain. These break up about the middle of March, and then it is often impossible to find the species locally, until the transients arrive from the South the middle of April. The last individuals retire northward with the height of the migration in May." Besides this we learn further that on Long Island it is an "abundant transient, fairly common winter resident, particularly at the western end; September 10 to May 30." In the rest of the New York area it winters "commonly near the coast, rarely up the river to Ossining," while in the New Jersey area it is an "abun-

dant transient throughout; common winter resident near the coast and along the southern boundary of our area, decreasing inland, and unrecorded at this season in the extreme north and northwest." There are also extreme dates for all of the special localities previously mentioned. A more explicit account could hardly be desired!

The life zones and species characteristic of each have been considered with much care, the difficulty of delimiting them in this region being fully discussed. This is due, of course, to the fact that New York City lies just on the border line between the Carolinian, an austral or southern zone, which follows up the coastal plain, and the Alleghanian, a more northern zone. The Canadian or Boreal element appears mainly on the higher mountains of New Jersey and upon eastern Long Island.

Most interesting to the amateur bird student is the careful and detailed account of the migrations and the grouping of the species which migrate together and form the so-called "bird waves" of spring. Students in other "regions" will eagerly compare these lists and dates with their own.

The painstaking work which field students of birds have been doing in the New York region and which has made possible the detailed statements presented in this volume, is shown by the fact that one of Mr. Griscom's collaborators, Miss Anne A. Crolius, visited Central Park in search of bird records more than 250 times *annually* from 1895 to 1915. The sifting out and summarizing of the vast amount of data that the author has collected have been an enormous job, of which the consideration of the published records has constituted no small part. To decide which sight records to accept

and which to reject is a difficult and thankless task. We can usually detect the careless and unreliable observer, but there are many well-meaning students who, lacking the knowledge of how best to recognize birds in the field, make errors by trying to find characters that are to be seen only when the bird is in the hand. And, again, many of our popular names prove to be sources of error. Misled by the names, the beginner tries to separate the yellow-billed and black-billed cuckoos by the color of the bill, whereas it is the tail that furnishes the best distinguishing character; or, to take another case, many an adult male white-throated sparrow, differing so much from the more somber-colored female and young male, is recorded as a white-crowned sparrow, for has he not a splendid white stripe down his crown? Doubtless just such cases as these impressed Mr. Griscom with the importance of setting forth the real field characters of each species as an aid to field students of the future and to eliminate errors in the constantly increasing mass of sight records being published.

The sad side of Mr. Griscom's account of the bird life of the vicinity of New York is his reference to the changing conditions inevitable in the vicinity of a great city. The Florida gallinule, coot, and pied-billed grebe, we are told, are disappearing or have disappeared as breeding birds because the marshes "are constantly being drained or filled in to 'improve' the neighborhood by providing another slum district on the outskirts of the metropolis"; while "Staten Island, which fifteen years ago was chiefly unspoiled country. . . is now almost

ruined for birds." "Over a sufficiently long period," says our author, "the survival of any species depends upon its adaptability to a changing environment, but how acid the test which man has furnished in the New World! There is no doubt that some [birds] could not endure this test; they have utterly disappeared from this region. Many others are retreating as a great city sends out ever-stretching tentacles into the rural districts. No bird can live on asphalt and concrete. But if city blocks are contrasted with primeval forest, most of this area may be regarded as a half-way compromise. This compromise a great majority of our birds have accepted."

"May the time never come," Mr. Griscom concludes, "when I can hear only the harsh chatter of the Starlings from my house in the suburbs. May the time never come when I stand some May morning on the beach and miss the little Sandpipers trotting innocently ahead of the tide, and gaze out to sea over a birdless ocean."

An aroused public sentiment is our greatest reliance in preventing the annihilation of our wild bird life, while the increase of bird students is the best way to arouse sentiment, and Mr. Griscom's volume, which will stimulate and increase bird study in the New York region, will aid not a little in warding off that evil day against the coming of which he cries out.

The volume is attractively gotten up, well printed, and illustrated with thirty bird portraits from photographs from life by various contributors, half a dozen colored plates selected from the National Audubon Society *Leaflets*, and a good map.

"In Brightest Africa"

A REVIEW OF CARL E. AKELEY'S NEW VOLUME ON WHAT HAS BEEN
MISNAMED THE DARK CONTINENT¹

By HERBERT F. SCHWARZ

Editor of NATURAL HISTORY

A TRAVELER through a new country sees in the landscape the things that accord with his tastes and training. An artist has an eye for its pictorial beauty, its groupings of color, its strength or delicacy of contour, its contrasts of light and shadow under the ever-changing play of the clouds. To the historian, on the other hand, the same region is the scene of great events of the past or the present; the topographical features stand out not for their beauty of form but as points of vantage from which an occupying force succeeded in turning the fortunes of battle. To a geologist the same stretch of territory is a tablet on which has been inscribed the story of the ages antedating the coming of man.

So in journeying through Carl E. Akeley's *Brightest Africa* different points of significance will be seized upon by different readers, for this unusual volume is as many-sided in its appeal as its author is versatile in his attainments. The sportsman will read it, feeling that it is a collection of adventures such as few big-game hunters have been fortunate enough to live through and relate, culminating in the account of a bare-handed fight with a leopard when with his right arm chewed along practically its entire length, Mr. Akeley still struggled on, the leopard beneath him, his right hand in her mouth, his left hand clutching her throat, his knees on her lungs, his

elbows in her armpits spreading her front legs apart so as to render futile her frantic clawing. And with this incident the reader who kindles to the narrative of dangers heroically faced will couple the dramatic account that Mr. Akeley gives of the time when to escape being gored by an infuriated elephant, he swung himself between the animal's tusks, only to be flung down to earth as the elephant drove its tusks into the ground in an attempt to crush him, an attempt that failed providentially because these ivory weapons struck a rock or other resistant object and thus prevented the mighty head from mashing the intended victim.

Perhaps the reader is an inventor or one interested in invention. To him the volume will present a different angle of interest, for he will see in it the record of a man who in the course of opening up a new field of achievement had to devise new tools, and who when confronted with a mechanical difficulty that threatened to arrest further progress never failed to puzzle out the means with which to overcome it. In 1909, Mr. Akeley endeavored to get moving pictures of the Nandi spearing lions. His results were unsatisfactory because "to have even a fair chance of following the action with a camera you need one that you can aim up, down, or in any direction with about the same ease that you can point a pistol." There being no such camera, Mr. Akeley, relying—and not vainly—on

¹*In Brightest Africa.* By Carl E. Akeley. With a Foreword by Henry Fairfield Osborn. Published by Doubleday, Page & Co.

his supreme resourcefulness, proceeded to construct one. In like manner years previously he had invented the cement gun to meet a special emergency, elaborating it from a device he had used in connection with the making of manikins. In the course of the world war, he was a specialist on mechanical devices and optical equipment in the Division of Investigation, Research, and Development of the Engineer Corps, and among other achievements, developed a device for searchlight control.

Again, the volume may be viewed not from the standpoint of the hunter, nor as a record of invention, but as the account of the birth of a new art, the art of taxidermy. When Mr. Akeley began his career in Ward's Natural Science Establishment, taxidermy was merely a trade and the taxidermist "a man who took an animal's skin from a hunter or collector and stuffed it or upholstered it." It is thanks largely to the tireless energy of Mr. Akeley, to his unfaltering fidelity to an ideal, to his practical sense and his artistic outlook that the world owes the marvelous transformation in the methods and technique of mounting animals. To any one who has stepped into Mr. Akeley's studio, it must be obvious that taxidermy to find its highest form of expression requires the convergence of a number of qualities and special talents that only now and then are summarized in a single individual, and that of these artistic vision is not the least important.

While Mr. Akeley has taken a leading part in creating the new art of taxidermy, he has been a successful exponent of an art that antedates Phidias. His animal sculptures owe their appeal not only to truth of conception and beauty of form but to the fact that, as he tells us, he decided never to make a

bronze unless he had a real story to tell, and most of the dramatic stories that he has carved in the plastic clay are based on his personal experiences in the wild.

That brings us to another phase of interest which this volume presents, the surprising richness of its information regarding the great jungle beasts. It is the record of one who has gone to Africa with an alert eye and, more important still, a mind that welcomes the opportunity to study animals under natural conditions. An ivory hunter, he tells us somewhere, sees only the tusks of an elephant; Mr. Akeley sees his animals whole. The trunk of an elephant, the front legs of a lion—how easily they might be slurred over in a general description by some one less keenly sensitive to their marvelous structure and their functions than is Mr. Akeley! The natural impulse of an animal to defend itself—how often has it been libeled by writers whose interest in the great beasts of the jungle is merely as objects of the chase! Mr. Akeley knows as few have known the strength and fury of a wild animal's charge, and yet from cover to cover his book teems with evidences of an understanding of, and interest in, the animals among whom he has moved, again and again hazarding his life to obtain a fuller knowledge of them.

The question may be asked, has a volume so many-sided as this is, unity of appeal; is it not merely a series of papers raked together and labeled with a general title more or less pertinent? To ask the question reveals an ignorance of the goal of all of Mr. Akeley's varied activities. Among the several things he lists as prerequisites of a real taxidermist he places first experience as a field man, for a field man can collect his own specimens, take accurate

measurements of them, and study the animals in their own environment as a preliminary to making natural groups. That is why Mr. Akeley went to Africa; that is why the African chapters have a close connection with the portions of the book that are devoted to taxidermy. In like manner animal sculpture is a natural product of the field experiences of one who in the course of establishing an art of taxidermy has found that the modeling of animal forms is a prerequisite of the effective mounting of skins. His inventions are essentially devices which he needed for the successful prosecution of his work or their extension with modifications to meet other emergencies as these arose.

At the close of his first chapter Mr. Akeley says: "When I got back from Africa in 1911 I was dreaming of a great African Hall which would combine all the advances that had been made in taxidermy and the arts of museum exhibition and at the same time would make a permanent record of the fast-disappearing wild life of that most interesting animal kingdom, Africa." One cannot help feeling that the hope of realizing such a hall has been the main incentive of Mr. Akeley's later work, and it is fitting therefore that the final chapter of the volume

should be on "Roosevelt African Hall." The work demanded for the realization of this dream is on so vast a scale that it will require the coöperation of many hands, but the directing mind assures absolute unity of plan. There will be forty groups, dominated by the magnificent elephant group that is at present installed on the second floor of the American Museum, and as part of the architectural decoration of the hall there will be twenty-four bas relief panels in bronze, each six by eleven feet. The association of Roosevelt's name with this splendid memorial recalls the fact that it was through Mr. Akeley's glowing description of Africa that the President was influenced, upon completing his term of office, to go to that continent in preference to any other.

"Sculptor and Biographer of the vanishing wild life of Africa" is the way Prof. Henry Fairfield Osborn describes Mr. Akeley in the eloquent foreword he has written for the volume, and those who turn the pages of *In Brightest Africa* will find among the illustrations (several of which are photographs of Mr. Akeley's masterpieces) full justification for the former designation, and in his text, so replete with admirable records of animal life, indisputable support for the latter.



NOTES

ASIA

WELCOME BY THE GEOLOGICAL SOCIETY OF CHINA.—During Prof. Henry Fairfield Osborn's sojourn in Peking he was, with Mr. Roy Chapman Andrews, a guest of honor at a number of brilliant functions. On September 27 he addressed the Geological Society of China on the topic "The Broader Aspects of the Work of the Third Asiatic Expedition." Chinese men of science as well as resident European and American scholars, leaders in different fields of intellectual endeavor, attended the gathering in numbers and extended a warm welcome to him as he arose to deliver his address at the conclusion of the cordial words of introduction spoken by Dr. V. K. Ting, the president of the society. Professor Osborn expressed the deep indebtedness of himself and his colleagues of the Third Asiatic Expedition, who were present at the gathering, for the hospitality extended to them by the Geological Survey and the Geological Society of China, which, he said, would be treasured in their memory as one of the pleasantest experiences of their sojourn in a land "where scholarship and learning have always been held in high esteem." Turning to the subject of his address, "The Broader Aspects of the Work of the Third Asiatic Expedition," he compared the survey made in Mongolia by Mr. Andrews and his associates with that conducted by Hayden, the middle of the last century, in the then virgin field of our own West. The astounding results obtained in Mongolia within a period of only a few months as contrasted with the span of years required by the Hayden survey were made possible by the effective modern means of transportation at the command of the expedition.

Mongolia, Professor Osborn pointed out, has been a continent ever since Jurassic time, and this stable condition was conducive to a continuous development of life. Some of the deposits containing fossils are, moreover, of enormous thickness, others of surprising extent, and these deposits have yielded types of animals adapted to all varieties of environment that existed in the successive periods of the sedimentation. During the second year of the expedition the sites located in the reconnaissance of the first year have been worked systematically and with such a marvelous abundance of yield that had Professor Osborn

been asked at the inception of the expedition what he desired to secure in the way of collections, he would have deemed it "an act of tyranny to request Mr. Andrews to obtain just what he has brought back." Professor Osborn then spoke of the objectives still ahead of the expedition and ventured the opinion that if primates are found in any of the deposits, they will prove to be of the higher type. Another discovery that, it is hoped, the expedition may be able to make is of the assumed five-toed ancestors of the early four-toed mammals. Professor Osborn closed with a warm tribute to the character of the men engaged in the expedition and to the splendid generalship of Mr. Andrews. The latter succeeded him as speaker and was followed in turn by Mr. Granger and Doctor Morris. Mr. Andrews in the course of his remarks dealt with the problems of organization, the equipment, and the field work of the expedition, while Mr. Granger and Doctor Morris spoke respectively of the palaeontological and geological work undertaken and the observations made.

At a dinner held at the conclusion of the day's proceedings Doctor Ting presided and Mr. Andrews, Dr. W. H. Wong, director of the Geological Survey of China, Prof. J. S. Lee, of the Geological Institute of the National University, and Professor Osborn delivered addresses. In closing his remarks, Doctor Ting announced that the Geological Society of China had unanimously elected Professor Osborn an honorary member of that body. He referred to Professor Osborn as "the man most prominent in carrying on the Huxleyan tradition."

AN ESTIMATE OF THE MONGOLIAN DISCOVERIES.—Under date of December 3 Prof. W. B. Scott of Princeton wrote Prof. Henry Fairfield Osborn as follows:

I was delighted to get your letter, posted at Seattle, and congratulate you most heartily on the magnificent success of your Mongolian expeditions. To me one of the most gratifying features of your results is the fact that they all go to confirm the inferences which we had made from American data and do not require us to tear down all the building which we have been so laboriously erecting. The discovery of *Loxolophodon* is precisely in line with what one might expect, but the Paleocene, which will surely come to light some day, will be the key to the whole story. The dinosaur eggs are delightful, all the more so for not being revolutionary. When Professor Pum-

pelly (of whose recent death you have doubtless heard) was here a couple of years ago. I inquired particularly whether in Central Asia, or the Gobi Desert, he had ever discovered any signs of fossil mammals or reptiles, explaining that we had every reason to believe that Central Asia would prove to be the cradle of the higher mammalian groups. He replied that he could give me no hopes of such discoveries, as he had never seen a sign of fossil bones in those regions. Isn't it wonderful how blind eyes, not trained to see particular things, can be toward these things? His answer disappointed me very much, but, as it turns out, quite unnecessarily.

THE FAUNTHORPE-VERNAY INDIAN EXPEDITION OF 1923, which members of the American Museum were privileged to view in all its superb equipment through the motion pictures that accompanied Colonel Faunthorpe's informing lecture, has interested the press of both England and America for, in addition to its importance as an expedition, the fact that it should have been undertaken by two English gentlemen at great personal sacrifice of time and money so that an American institution might reap the benefit is an example of international good will of which both sides of the Atlantic rightly take cognizance.

Mr. Vernay on his return from India was interviewed both in England and America, and interesting accounts based on his spoken and his written word have appeared in these countries. Among the more detailed narratives was that which appeared over his name in *The Spur* for November 15, 1923, accompanied by twelve illustrations. In this article Mr. Vernay paid high tribute to Colonel Faunthorpe as "probably the finest shot in India at a running animal, and a most able organizer," adding that "organization in an expedition of this kind means half the battle." So jealously are certain of the animals in India guarded that a native who kills a rhino, for instance, is fined a thousand rupees and for a second offence is put to death, while permission to shoot an elephant is given only in extraordinary circumstances. Yet, thanks to the influence of the leaders of the expedition, groups were obtained not only of these animals but of a number of others.

Dramatic is the account which Mr. Vernay gives of the hunt of the rhinoceros and of the care which Colonel Faunthorpe and he took to study its anatomy prior to entering the field, so as to be assured of aiming the bullet at the most vulnerable spot. Equally absorbing is his narrative of elephant hunting, of ringing

the tiger, and of tracking the tsine. In reading the article one cannot escape the feeling that the Museum has been singularly fortunate in enlisting the interest of two sportsmen who proved themselves such splendid organizers, such expert marksmen, and such devoted workers in the field of science.

GEOLOGY

THE GEOLOGICAL SURVEY OF CHINA.—President Henry Fairfield Osborn of the American Museum brought back from the Far East not only the recent publications of the Geological Society of China but also those of the Geological Survey. In order to avoid duplication of work and assure the most useful coöperation between these organizations and the American Museum's Third Asiatic Expedition, Mr. Roy Chapman Andrews acceded to the wishes of Director V. K. Ting and Dr. J. G. Andersson of the Survey to a regional division of the field of research. Thus the Museum's expedition, equipped with rapid motor transport, agreed to work in the outlying areas which cannot be readily reached by the Chinese Survey.

We note that the Survey and the Society have not only accomplished much in recent years but that they have outlined a very extensive program. To Dr. H. C. T'an has been confided the important task of the new topographical survey of China. He has mapped the entire province of Shantung and most of that of Shansi, scale 1:100,000, and is pursuing this work with vigor. Dr. V. K. Ting has just returned from a study of Yunnan, where he has made detailed cross sections that throw much needed light upon the structure of that most complex region. Mr. George B. Barbour reports a study of the intrusive of Tsinan Fu. This is a great mass of dark-colored volcanic rock that has cut through thick beds of limestone, and now lies exposed by erosion north of the town of Tsinan Fu in Shantung. The molten rock and the volatile matters that rose from it have attacked the limestone, changing it to a series of rare and interesting minerals.

Of special importance is an analysis of recent earthquake records in China by Dr. W. H. Wong. He has plotted the centra and isoseismic lines from all the data available. It will interest readers of *NATURAL HISTORY* to learn through his research that the terrible Kansu earthquake of 1921, in which more than 100,000 lives were lost, was on a wholly differ-

ent geologic structure from that which conditioned the recent earthquake in Japan.

The Survey has also published papers by Dr. J. G. Andersson, notably, "The Cave Deposit at Sha Kuo T'un," "An Early Chinese Culture," and "Essays on the Cenozoic of Northern China." In the last paper Doctor Andersson discusses eighteen fossil eggs of the extinct ostrich, *Struthio lithus chersonensis*. All of these eggs were found at various localities in the loess of China. Find No. 15 is in the American Museum. These eggs are somewhat larger than those of the living ostrich, *Struthio camelus*. Some eggs have been found as broken shells in association with the culture of early man, others in pairs in a nest which the loess covered up and preserved for thousands of years. The conditions of entombment and preservation of these remarkable bird eggs are not unlike those of the much older dinosaur eggs which the Third Asiatic Expedition found in the desert plains of Mongolia and brought back to the American Museum.

It has been arranged that Prof. A. W. Grabau, who serves China in the joint capacity of paleontologist to the Geological Survey and professor of paleontology in the National University of Peking, will report upon the invertebrate fossils collected by the Museum's expedition to Mongolia. In 1922 the Survey published Professor Grabau's paper on "The Sinian System," a review of the second volume of the monumental work of Ferdinand von Richthofen on the Geology of China (Berlin, 1882), as well as "The Ordovician Fossils from North China" and "The Paleozoic Corals of China." At present Professor Grabau is engaged upon a very large work, *The Palaeogeography of Asia*. In his opinion the greatest discovery that the Third Asiatic Expedition has made in Mongolia is that of the Permian geosyncline.

The directors of the Geological Survey of China, Dr. V. K. Ting and Dr. W. H. Wong, are to be congratulated on the splendid work that they and their staff are accomplishing for the Republic of China.—C. A. R.

OTHER MUSEUMS

PORT ELIZABETH MUSEUM.—To Mr. F. W. FitzSimons, director of the Port Elizabeth Museum, South Africa, NATURAL HISTORY is indebted for the two Notes printed below recording recent paleontological discoveries in Africa:

The mineralized skullcap and part of a jaw that were discovered at Boskop in the Transvaal some years ago and that are now in the Port Elizabeth Museum, baffle anthropologists because the find stands alone as a type, no other ancient skulls being comparable with it. I have now found two very important links to support the theory that the Boskop man typified the race which originally inhabited South Africa, and made the bouchers and other large, roughly chipped stone implements scattered so profusely over the country.

In digging out some rock shelters in the cliffs at Zitzikama on the seacoast, I found the remains of two men with palaeolithic implements that had been buried with them. These were fourteen feet below in the midden of ash, sea shells, and remains with which the rock shelter was filled from the floor to within a few feet of the roof. From the area extending from the surface to a depth of about twelve feet there were taken out large numbers of skeletons of an altogether different race, closely related to the Pygmy Bushmen of the interior rock shelters. The two skullcaps are those of men with exceptionally big brains. The Boskop man possessed a phenomenally large brain, and it is significant to find two palaeolithic men, deep down in a rock-shelter midden, with similarly large skulls. It would seem that there was a very early type of man with a brain as large and even larger than that possessed by modern men of genius. It is worthy of note, however, that the bulk of brain in the skulls of these ancient men was located at the base, back, and sides, and that in modern men of exceptional mental attainments the brain is massed in the forehead and temple regions.

In times far remote there roamed over the karoo and high veld a buffalo that was of enormous proportions compared with the living species of today. Remains of this animal were first discovered forty feet below the surface on the banks of the Modder River in the Orange Free State and were described as *Bubalus bainii* by Prof. H. G. Seeley in the *Geological Magazine*, New Series, Decade III, Vol. VIII, page 199, 1891. The specimen in question is remarkable for the enormous length of the horn cores, each of which measures 5 feet, 2 inches in length. It is now in the possession of the South African Museum. Another specimen has just come to light. Mr. Herman Bekker discovered the head of a huge animal and notified me of the fact. Later he sent the remains to me, and on examination they proved to be those of the large buffalo. The skull is fragmentary, but one horn core is sufficiently intact to make possible a measurement of the length, which is 5 feet, 3 inches. The forehead between the horns is 8 inches. This means that, when alive, the beast had a pair of horns 11 feet, 2 inches across from point to point. A buffalo with such monstrous horns could not have lived in forests or even in the bush-vel. It must have been a dweller on the open plains

of the Orange Free State at a time when that country probably had a regular rainfall and many flowing rivers.

THE LAST SURVIVOR OF THE "POLARIS" EXPEDITION

A recent press report to the effect that Mr. J. W. C. Kruger, believed to be the last survivor of the "Polaris" expedition, has died, justifies a few words of comment regarding one of the most remarkable feats of adventure that the annals of exploration contain. It was on June 29, 1871, that the "Polaris," a screw propeller of only 387 tons, left the Brooklyn Navy Yard, under command of Captain C. F. Hall, on the United States North Pole Expedition. The premature death of Captain Hall, who succumbed to a mysterious illness shortly after the expedition reached Thank God Harbor, Greenland, was but the prelude of many misfortunes.

Of these the most spectacular had its inception on the night of October 15, 1872, when the "Polaris" ran into a storm and was subjected to the deadly constriction of the impressing ice. The boat seemed to be in imminent danger and ill-advisedly orders were given to throw the provisions and other necessities on the ice. A party under the direction of Captain George E. Tyson descended to the ice to place the salvaged articles at a safe distance from the boat, which as it rose and fell threatened to grind to pieces any luckless object that came in contact with it. While they were thus engaged, working amid the darkness and the storm, scarcely able to distinguish the things they were handling, the ice on the starboard side gave way, releasing the ship, which almost immediately lost contact with the group that had disembarked. Next day the "Polaris" was glimpsed by the men on the ice floe but instead of steering toward the desperate group, unaware of their location, she disappeared behind the land.

Now began one of the most remarkable of voyages. Here was a party of nineteen, including women and children, a party having neither compass nor chart, with inadequate food, semi-mutinuous, adrift on a floating island of ice on a journey that was to consume months and cover 1500 miles. How these people endured, without warmth, in snow igloos they constructed, how they came to look even upon the frozen raw entrails of a seal as something desirable to still their

hunger, how their strength ebbed, and how the taking of desperate chances was favored by the more reckless members of the party—all this is told in Captain Tyson's fascinating volume. On April 30, after more than six months of exposure, they were picked up by the "Tigress" and subsequently the party that had been left behind in the north was rescued by the "Ravenscrag."

The American Museum, the depository of so many interesting mementoes of exploration, to the inclusion of one of the sleds with which Peary made his dash to the Pole, has at least two reminders of the heroic adventure of the "Polaris,"—a whale boat abandoned at Thank God Harbor and there found by Peary, and a large painting of the "Polaris" at Thank God Harbor executed by William Bradford, justly celebrated for his vivid depiction of northern scenes.

THE HARRISON WILLIAMS GALÁPAGOS EXPEDITION

A special exhibition of paintings, collections, and other material pertaining to the Harrison Williams Galápagos Expedition was held at the American Museum December 1-14 under the auspices of the ladies' auxiliary of the New York Zoological Society (Mrs. Henry Fairfield Osborn, chairman) in coöperation with the Museum. Due to a shortage of water and the unexpected difficulties in replenishing the supply, this expedition, sent out by the department of tropical research of the New York Zoological Society under the direction of Mr. William Beebe, was able to spend only one hundred hours altogether in the archipelago; but judging by the impressive exhibit, the sojourn might well have been one of weeks. Of special interest were Miss Isabel Cooper's superb studies in water color of the animals of the region, ranging from marine forms to terrestrial forms like the spectacular giant land iguana, and Mr. Harry Hoffman's inspiring landscapes, seascapes, and skyscapes, one of the most exquisite of the pictures being an overhead view of flying frigate birds seen against the cloud-flecked blue of the sky. A sketch model for a group of marine iguanas assembled on the rocks and in the sand of a lava-rimmed patch of beach was the work of Mr. Walter G. Escherich, the background having been painted by Mr. A. A. Jansson. There were also relief models of the several islands visited, placed with the marine and

land birds taken by the expedition. A collection of insects and numerous impressive photographs were other features of interest.

A PRECIOUS MANUSCRIPT

A page of the original manuscript of *The Origin of Species* was received by President Henry Fairfield Osborn under date of September 21, 1922, from Major Leonard Darwin, whom the members of the American Museum will remember as the retiring president of the Second International Congress of Eugenics. The page in question, a reproduction of which appears herewith, corresponds with the subject matter on pp. 187-88 of Volume I, Chapter 6, of the original edition of Darwin's epoch-making work. In later editions changes were introduced, altering to a large extent the wording of the upper part of the manuscript page.

This precious gift has a double significance: in the first place as an historic document of the greatest interest, and in the second because of the fact that it has been bestowed by the author's son, who through his own contributions in the field of science has added new laurels to the name of Darwin. The manuscript, as well as the copy of the original edition of *The Origin of Species*, has been mounted and placed on exhibition in Darwin hall, American Museum, beside the bust of the great naturalist.

CONSERVATION

A NECESSARY STEP TO SAFEGUARD THE BIRDS OF LOUISIANA.—A tract of land 100,000 acres in extent, which because of its location ought to be a link in the chain of Louisiana wild-life sanctuaries, has recently been acquired by a group of sportsmen, who contemplate converting it into a private hunting reserve, to be known as the Louisiana Gulf Coast Club. Although those promoting the scheme were actuated not merely by the desire for sport but by the hope of developing the possibilities of the area as a wild-life center, the proposal is incongruous, and the only proper destiny of this tract is as an essential element in a larger scheme for the protection of the birds of the Gulf Coast. As envisioned by Mr. T. Gilbert Pearson, president of the National Association of Audubon Societies, the existing bird reservation should be extended so that the territory embraced may stretch without a break from Cote

Blanche Bay westward to the Mermentau River, a belt about eighty miles in length and from ten to fifteen miles in width. As a step toward the fulfillment of this plan the acquisition of the tract owned by the Louisiana Gulf Coast Club is essential, and it is to be hoped that public sentiment may be sufficiently emphatic and public support of Mr. Pearson's efforts sufficiently potent to assure the realization of his plan.

THE STATUS OF THE ANTELOPE.—For years the prong-horned antelope, one of the most distinctive and beautiful of American game animals, has been decreasing in numbers so rapidly that it is threatened with extinction in a comparatively brief period unless some definite steps are taken to insure its perpetuation. The decrease in these animals has been so alarming that many of those interested have expressed a desire that a meeting be called for the purpose of considering the present situation and, if possible, to formulate plans which may result in the conservation of the animals.

Such a meeting was held on December 14, 1923, at the U. S. National Museum in Washington. Representatives of all the principal conservation organizations of the eastern United States, in addition to a representative of the Canadian Government, and representatives from state game commissions in various parts of the country attended the conference, which was sponsored by the Bureau of Biological Survey. It was agreed at the meeting that conservation work in favor of the antelope could best be carried out through existing conservation organizations, aided by the Bureau of Biological Survey, which would act as a clearing house for information on the subject.

The Bureau of Biological Survey during the last two years has been conducting a census of the remaining herds of antelope and has practically all of them located and the approximate number in each herd determined. Dr. E. W. Nelson, chief of the Bureau of Biological Survey, to whom *NATURAL HISTORY* is indebted for the data contained in this Note, expects in the near future to prepare a bulletin which will set forth the information available at the present time. The bulletin will also give maps of each of the sixteen states in which antelope occur, with the location of the herds, the number in each, and other information, in order to afford a definite basis for conservation work.



A model of the three-horned American dinosaur, *Triceratops prorsus*, that, palm-embowered, greeted President Henry Fairfield Osborn on his return to the American Museum after his sojourn in Asia, the home of the ancestral ceratopsians. The model was designed and prepared by Messrs. Charles Lang and Otto Falkenbach

VERTEBRATE PALÆONTOLOGY

WELCOMED HOME BY A DINOSAUR.—A dinosaur head, life size, emerging from a bower of palms and ferns arranged in one corner of the Osborn Library greeted the eyes of Honorary Curator Henry Fairfield Osborn of the department of vertebrate palæontology, on November 7, on the occasion of his welcome home from Asia by the members of the laboratory force of the Museum.

This model of the head of *Triceratops prorsus* was designed and prepared as a surprise by two members of the laboratory force, Charles Lang and Otto Falkenbach, who discovered a new method in the use of papier-mâché materials for the frill and for the polished horns and polished horny beak. Other members of the department force, headed by Curator Matthew, had assembled in the Osborn Library just before the honorary curator was led in to witness this wonderfully lifelike reproduction. The eye of this ceratopsian was represented as quite genial, because the animal enjoys the reputation of having been entirely defensive in its habits; it did not seek trouble but went about avoiding it, with the most effective piercing horns

which nature has ever invented and with a bony frill at the back of the head designed to protect all the nerve centers of the upper part of the spinal cord.

That a model of a three-horned American dinosaur of the very closing period of the Age of Reptiles was chosen with which to welcome the return of Professor Osborn from a visit to the fossil beds of Mongolia was most appropriate, because *Triceratops prorsus* is probably a direct descendant of the already famous egg-laying dinosaur *Protoceratops andrewsi* of western Mongolia, described by Dr. William K. Gregory. The head was modeled exactly after the superb skull and bony horns of the complete articulated *Triceratops* skeleton which is now on exhibition in one of the halls of vertebrate palæontology.

REPLICAS OF BALUCHITHERIUM DISTRIBUTED.—A replica of the minute tooth of *Hesperopithecus* presents the widest possible contrast to the facsimile cast of the gigantic skull of *Baluchitherium*. The story of *Baluchitherium* as described by Professor Osborn in the issue of *Asia* for September, 1923, is a romance in itself:

It took several days to work the skull out

of the earth. It was transported across the desert of Mongolia and reached Peking on October 20, 1922. It reached the American Museum on December 19, 1922—a red-letter day in the Department of Vertebrate Palaeontology, which received it. The scientific preparation began immediately and continued unremittingly in the hands of two, three, and sometimes four preparators, until its completion on April 6, 1923. It was then ready to be reproduced a thousand-fold in still photographs and by the moving-pictures of Mr. Shackelford, and thus distributed in this country and all over the world.

It required several months of additional work to prepare and color in facsimile this superb skull and jaws. The casting was done by Mr. Otto Falkenbach, the coloring by Miss Helen B. Cox, who made constant reference to the beautiful colors of the original. Finally the facsimile copies were finished and sent to the following institutions—the Museum of Cambridge University, the Museum of the Academy of Sciences of Petrograd, the British Museum (Natural History), the National Museum, Yale University, and the University of California—the first one going to Mr. C. Forster Cooper, the discoverer of the genus *Baluchitherium* and curator of the Museum of Cambridge University.

FOSSIL BIRDS FROM NEBRASKA.—Bird remains are exceedingly rare fossils, save in a few exceptional deposits. In certain former lake beds, such as the Christmas Lake, or Fossil Lake, of eastern Oregon, or at St. Gerand-le-Puy in France, the bones of aquatic birds are as common as those of mammals; and among the fossils of the asphalt deposit at Rancho la Brea near Los Angeles are numerous birds of prey and a few other birds which were trapped in the asphalt. In the swamps of New Zealand, Madagascar, and Australia numerous remains of extinct gigantic ground birds have been found: *Dinornis* and its relatives in New Zealand, *Aepyornis* in Madagascar, *Genyornis* in central Australia. But in most of the Tertiary formations of our West bird bones are almost unknown. The discovery of the skeleton of the giant ground bird *Diatryma* in Wyoming was a bit of rare good fortune. Aside from this, the results of fifty years' collecting in the badlands of the West by Cope and by the representatives of the American Museum are two or three trays of specimens, none of them complete, most of them consisting of single bones or parts of bones.

Expert identification and study of these scanty and fragmentary remains require a thorough knowledge of the comparative osteology of birds such as very few ornithologists possess. The American Museum has been very fortunate, therefore, in being able to place some recent finds of Tertiary birds in the hands of Mr. Alexander Wetmore of the Bureau of Biological Survey at Washington for study and description. An article by Mr. Wetmore in the *Bulletin* of this Museum has just appeared, describing the remains from the Snake Creek and Agate fossil quarries in Nebraska. Among the most interesting of these are bones of an extinct species of *Urubitinga*, a large hawk now found only in Central and South America, and of a small milvine hawk, or kite, whose nearest modern allies are the Mississippi and Everglades kites.

These, therefore, are to be added to the long list of birds, mammals, and other animals which, inhabiting North America in the Age of Mammals, were driven southward, whether by changing climate or by the competition of invading races from the north, and have left more or less modified descendants in tropical America or along our southern borders. Such are the tapirs, peccaries, and llamas, the alligators and crocodiles, certain turtles and lizards, fishes, insects, and mollusks of which we are so fortunate as to have the fossil records. Without doubt many other animals and plants will in time be added to the list.—W. D. M.

PALEONTOLOGY IN RUSSIA.—American palaeontologists are deeply interested in the progress of palaeontology in Russia and will be gratified to learn that Mme. Marie Pavlow has for four years past held a professorship of palaeontology in the University of Moscow and that at the present moment she is deeply engaged in preparing for the publication of her courses of palaeontology, beginning with the invertebrates and following with the vertebrates. Under date of August 25 she writes enthusiastically of the reception in Russia of Professor Osborn's volume *The Origin and Evolution of Life*, as translated into French by M. Felix Sartiaux and now in its third printing. Her own field of work in recent years has been principally among the rich collections of proboscideans, including both the elephants and mastodons, in the more recent Quaternary formations of Russia. We

owe to Mme. Pavlow the recognition of the true mastodon, very closely related to *M. americanus*, in Russia. In addition to issuing in instalments her work on the Tertiary mammals of Russia, she has from time to time published resumés of the progress of vertebrate palæontology in that country, which are invaluable to American workers to whom much of the original literature is not available.

PUBLIC EDUCATION

THE NEW YORK STATE FEDERATION OF WORKERS FOR THE BLIND held its annual convention in New York City, October 23-4. Dr. G. Clyde Fisher represented the American Museum at the meetings, which were held at the Lighthouse, 111 East Fifty-ninth Street, and at Stuyvesant High School. Through the Jonathan Thorne Memorial Fund, the Museum has been able during the last fifteen years to carry on valuable work with classes of blind children and the sight conservation classes in the public schools, and with the adult blind of New York City and its vicinity.

INSECTS

THE A. CRESSY MORRISON PRIZE AWARDED.—At the annual dinner of the New York Academy of Sciences, held on December 17, 1923, announcement was made by Dr. Ernest Ellsworth Smith that the A. Cressy Morrison Prize had been awarded to Dr. Frank E. Lutz, curator of entomology, American Museum, for his paper entitled: *Apparently Non-Selective Characters and Combinations of Characters, including a Study of the Ultra-violet in Relation to the Flower-Visiting Habits of Insects*. The competing papers numbered fourteen and were representative of original research in several distinct branches of science. Under such circumstances a decision is necessarily difficult, for differences of opinion may readily arise as to the relative merits of studies in such varied fields as physics, astronomy, biology, and the like. It is a tribute to the intrinsic importance of Doctor Lutz's contribution that all of the judges were in accord in placing his work at the head of the list. This is the second year that the prize has been awarded, and the interest that the contests have aroused and the high standard of the essays submitted are convincing testimony of the wisdom of Mr. Morrison in establishing the prize.

OBSERVATIONS OF THE BEES OF PANAMA.—Dr. Frank E. Lutz, curator of entomology, returned December 6 from Panama, where he spent a month studying the insects, especially the native bees, of the Canal Zone.

A part of the time was passed on Barro Colorado, the largest island in Gatun Lake. It contains about twelve square miles of dense and absolutely primitive tropical jungle. The only even partially cleared areas are several very small farms along one edge of the island. The government of the Zone has recently made Barro Colorado a biological reservation, prohibiting both hunting and any extension of agriculture. In view of the facts that, although an island and therefore readily protected, it is fairly accessible to visitors and that agriculture is rapidly destroying jungle in the Zone, this action by the government is particularly fortunate.

Through the courtesy of the U. S. Army, Doctor Lutz was able to explore the reservation from an aeroplane. He also established a camp from which he cut and fully blazed a trail across the island. This trail, the first to be blazed in this jungle, was laid out in such a way as to lead through different types of vegetation and by other points of interest, including a large settlement of leaf-cutting ants.

Doctor Lutz reports that the island, which is really the top of a mountain that became surrounded by water when Gatun Lake was flooded in the construction of the Canal, naturally contains a great variety of birds and mammals, such as parrots, monkeys, and tapirs. Almost any Panamanian animal that may be found to be lacking can be introduced. The jungle is so dense that it is practically impossible to penetrate it without first cutting a way through the vines, prickly stems, and other vegetation.

In addition to making a general collection of insects, including those bees that do not live in colonies, Doctor Lutz was successful in securing nests of several species of native social bees (*Meliponidæ*). These latter live in colonies, each colony having a queen and numerous workers, much as does the Asiatic honeybee that man has domesticated. They are not, however, closely related to the Asiatic bee. They do not sting but they do bite, and certain kinds eject a fluid that severely burns the human skin.

Bees of this group store honey in special cells about the size of grapes. There is often

a considerable quantity in a nest and in some cases it has a good flavor but, depending on the species of bee that made it, the honey may be rather tasteless, or too acid, or even poisonous. Some of these bees make their nests in cavities, such as hollow trees, the walls of houses, or holes in the ground; others build large hanging nests somewhat like those of the white-and-black hornet of our northern woods; while still others establish their colonies in the large nests made in trees by white "ants."

The most populous nest of which there is an available record contained about 75,000 bees and, although they do not sting, a thousand or so of these bees covering one's face, hands, and even the inside of one's clothing, each more or less gently biting, are rather uncomfortable.

THE WHITNEY SOUTH SEA EXPEDITION

In connection with Dr. Robert Cushman Murphy's lecture on the Whitney South Sea Expedition, there was installed in memorial hall, American Museum, an exhibit epitomizing the achievements of the expedition and offering at the same time a bird's-eye view of the wealth of scientific material supplied by this interesting region of the world. Ranged in cases were examples of the bird life of Polynesia, notable not only for its diversity but on account of the restricted range of certain forms,—for instance, the warblers of the genus *Conopodera* with twelve representatives, each confined to a single island or a small group of islands. Rare birds like Peale's petrel, of which only three specimens had been found prior to this expedition, the fruit pigeon of Rapa Island, known previously from only a single skin, and the Tuamotuan land kingfisher, interesting not only because it is new to science but because, departing from the piscatorial habits of most of its fellows, it feeds on insects and lizards, were among the prized acquisitions of the expedition. Of spectacular interest were the specimens of feral poultry,—descendants of the Asiatic jungle fowls which the Polynesian people carried to the South Pacific islands on their migrations; the red-tailed tropic bird, the long scarlet appendages of which are in some countries legitimately added to the stock of the milliner, like the down of the eider and the plume of the ostrich, seeing that they can be plucked without injury to the bird; fruit

pigeons of wonderful diversity, some with white crests, others with red or purple, or red rimmed with yellow, as well as harmonious or spectacular changes of coloration in other parts of their plumage; and finally an exceptionally rich representation of interesting marine birds, such as noddies, terns, petrels, and shearwaters.

While primarily an ornithological undertaking, the Whitney South Sea Expedition secured much interesting material falling within other fields. A number of mounted specimens of identified Polynesian plants were shown in one case; examples of the land crabs, certain fish, and shells were exhibited in another; and finally the excellent photographs taken by Mr. Rollo H. Beck and his associates, selections from which were placed upon a screen in back of the cases, showed not only the bird life of the islands but their scenic attractiveness, the physique and mode of dress of the natives inhabiting them, and their ancient stone idols. A Polynesian having seven toes and six fingers was represented in one of the pictures.

It was fitting that, by way of correcting the belief that the South Sea islands have come into public cognizance only in this generation, some impression should be given of the abundant literature devoted to this area of the world in earlier decades. Among the more arresting publications displayed were one of the twelve extant volumes of the suppressed issue of Titian R. Peale's account of the mammals and birds of the United States Exploring Expedition of the forties and Lady Belcher's volume on *The Mutineers of the Bounty*. Of direct bearing on the Whitney Expedition were the Field Note Books of Mr. Beck and his major contributions to *NATURAL HISTORY*, the Field Journal of his associate, Mr. Ernest H. Quayle, totaling five substantial volumes of typewritten sheets, and a volume of Notes on the Geography and Fauna of Eastern Polynesia prepared by Dr. Charles W. Richmond.

BIRDS

DR. F. M. CHAPMAN'S EXPEDITION TO CHILE.—On November 29, Dr. Frank M. Chapman, curator of the department of ornithology, American Museum, sailed for Chile, accompanied by Mrs. Chapman, Mr. F. C. Walcott, and Miss Helen Walcott. Two scientific purposes will be accomplished by this trip. The sojourn in Chile will enable

Doctor Chapman to continue in a new area the field studies that he has been making in connection with his work on the origin and distribution of Andean bird life. The initial volume of this comprehensive piece of research—*The Distribution of Bird-Life in Colombia*—has already been published; a second volume, dealing with the birds of Ecuador, is well advanced; and a third volume, to be devoted to the avifauna of Chile, will take shape as a result of the present studies.

The expedition will not confine its attention to Chile. The second purpose that it has set out to accomplish is the securing of material for a habitat group representing the bird life of the Pampas of western Argentina. Miss Walcott, in the capacity of artist to the expedition, will make the field sketches for this group. Mr. Walcott will act as photographer to the expedition, and Mrs. Chapman will assist in the preparation of specimens.

ANTHROPOLOGY

DR. WILLIAM W. GRAVES, of St. Louis, Missouri, well known for his anatomical researches, especially on the human scapula, its form and relation to disease, represented the American Museum at the inauguration of Herbert Spencer Hadley as chancellor of Washington University, November 10, 1923.

MR. N. C. NELSON, associate curator of archæology, returned to the American Museum after a ten weeks' field trip which took him to various states, including New Mexico, Oklahoma, Missouri, Illinois, Kentucky, and Virginia. Commencing in New Mexico in late August, he initiated Dr. Louis R. Sullivan into the art of recovering ancient Indian skeletal material from one of the Pueblo ruins, an undertaking which fortunately resulted in a considerable collection. Following this, three weeks were devoted to excavations at Jacobs Cavern, in the Ozark foothill country near Pineville, Missouri. The object here was to verify the apparent evidence (a bone with an engraved figure of a mastodon upon it) of Pleistocene man, discovered in 1921 and published in *NATURAL HISTORY*, Vol. XXI, No. 6. Expectations failed completely, inasmuch as nothing was found to indicate that man had lived in the cave in times prior to the arrival of the present fauna. Later, a remarkable Indian quarry-and-workshop of prehistoric date was examined in Ottawa County, Okla-

homa, not far from the Missouri state line. Here a small representative collection was obtained. ■■■■■■

This completed the summer's program, but Mr. Nelson took advantage of the occasion on his way home to inspect the famous Cahokia mound group near East St. Louis. As the guest of the Mammoth Cave Estate, he spent three weeks also in Kentucky, where he examined a number of caves as well as other sites reputed as showing evidence of Indian occupation. The principal discovery here was a flint quarry-and-workshop, apparently of considerable antiquity. Lastly, by invitation, the wonderful Luray and Endless caverns in the Shenandoah Valley, Virginia, were visited, but here nothing was found of archaeological interest.

Incidentally, Mr. Nelson was given opportunity to see two exceptionally fine private archæological collections, viz., that of Dr. H. H. M. Whelpley in St. Louis and that of the late General Gates P. Thruston, now exhibited at Vanderbilt University, Nashville, Tennessee.

MAMMALS

J. A. ALLEN MEMORIAL FUND.—This fund, established in honor of the Nestor of American mammalogists, Joel Asaph Allen, late curator of mammals in the American Museum, has now reached a total of nearly \$5200 toward the \$10,000 desired by the committee in charge. The income from this fund is to be used for the annual publication, as special numbers in the *Journal of Mammalogy*, of scientific papers dedicated to the memory of Joel Asaph Allen. *The Journal of Mammalogy* is the only periodical in the world devoted solely to this branch of natural history. The remaining \$4800 necessary to complete the fund will be secured, it is hoped, through invitation to all the mammalogists of the world and to members of the American Museum and the New York Zoological Society.¹

Among the first contributors to the fund were the President of the American Museum, Prof. Henry Fairfield Osborn, and several members of the Board of Trustees, including Messrs. Cleveland H. Dodge, Childs Frick, and Madison Grant, the last-mentioned being

¹Checks should be made payable to the J. A. Allen Memorial Fund. They may be addressed care of H. E. Anthony, Secretary and Treasurer, American Museum of Natural History, New York City.

also chairman of the central committee for the J. A. Allen Memorial Fund. Among the members of the American Society of Mammalogists, the chief contributors, in addition to those just mentioned, were Miss Annie M. Alexander, Messrs. S. Prentiss Baldwin, Thomas Barbour, George B. Grinnell, Ernest Thompson Seton, and the Hon. George Shiras, 3rd. Among the non-members of the Society, Mr. James B. Ford was most generous in his support.

The largest single contributions were three of \$500; next came one of \$200; one of \$125; nine of \$100; thirteen of \$50; one of \$40; twenty-nine of \$25; six of \$20; one of \$15; thirty-nine of \$10; one of \$7; fifty-seven of \$5; and twenty-seven of less than this amount. Interested friends and admirers of Doctor Allen who are not members of the Society contributed \$1250, which represents approximately one-fourth of the present sum subscribed.

Mr. H. E. ANTHONY, associate curator of mammals of the Western Hemisphere, returned to the American Museum early in December from field work in Ecuador. About four and a half months were spent in that country with Mr. G. H. H. Tate, field collector of the department of mammalogy, who remained in Ecuador to carry on the work after Mr. Anthony's departure. The material brought back by Mr. Anthony included about 1450 mammals, 450 botanical specimens, as well as small collections of birds, reptiles, fossil mammals, and about 250 photographic negatives. The collection of mammals comprises about 150 specimens of the rare genus *Cænolestes*, an animal formerly regarded as so rare that the taking of a single specimen was considered an achievement. The mammals collected range in size from a mouse up to a large deer, and were taken for the most part in the high mountain region about Quito.

The fossil mammals were obtained from beds of volcanic ash near Riobamba and represent the fauna of the Pleistocene. This part of the collection includes the one-toed horse, camel, deer, mastodon, wolf, possibly bear, and small forms such as rabbits, rats, and mice. Perhaps the most interesting specimen among the fossil material is the human skull that was found associated with the remains of the Pleistocene mammals. Whether this skull should be considered as

contemporaneous with the Pleistocene fauna is a point to be determined by careful comparisons after the skull has been cleaned and prepared for study. At any rate, the specimen is a very interesting one and is bound to bring forth a great deal of suggestive speculation.

Mr. Tate is now collecting along the line of the old mountain trail from Guayaquil to Quito, which has been little used ever since the railroad was built.

REVIEWS

"BIRDS IN LEGEND, FABLE AND FOLKLORE."—A volume thus entitled by Ernest Ingersoll, published by Longmans, Green and Co., is entertaining as well as informing. We are all familiar with the time-honored fiction that the ostrich hides its head in the sand, but to get a proper conception of the perverse ingenuity of the human mind in explaining nature not by observation and legitimate inference but by letting the fancy run wild, one must turn to the pages of this book, in which are presented a large number of curious misconceptions about birds, ranging from accounts engraved on the clay tablets of Babylon to the superstitions of the Southern darkey. That geese grow on trees, bursting fully fledged from fruit resembling apples; that the stork and other "season-observing birds" winter in the moon; that the ostrich hatches its eggs not through the warmth of its body but by the concentrated gaze of its eyes; that rooks are the ghosts of bad old landlords,—these are but a few of the quaint beliefs cited by the author, some of which enjoyed a wide vogue and were honored by picturesque variants.

OBSERVATIONS OF A BIRD PHOTOGRAPHER.—To secure a good picture of some little creature in the wild requires so much more skill and patience than to lodge a bullet in the broad target offered by some unsuspecting moose or deer that, taking into account man's joy in overcoming difficulties, it is surprising that the camera is not replacing the gun more rapidly. But after all, the exercise of skill is not the only consideration. The more intimate contact with nature enjoyed by one who records in contrast with one who destroys weighs overwhelmingly in favor of hunting with the camera.

What the bird photographer may glean from his close approaches to the nest is in

licated in a volume by Dr. A. H. Cordier recently published by Dorrance under the title of *Birds—Their Photographs and Home Life*. The author has included in it brief sketches of a great number of birds that he has observed in the course of his field trips, extending from the Aleutian Peninsula to the Gulf of Mexico, and near his home at Kansas City. While only incidentally a guide to the birds, the primary function of the book being to present a readable record of the habits of different species, the descriptions given of birds, their nests, and their eggs should be helpful in making identifications. Chapters on the principles involved in photographing birds and the equipment that is essential or desirable will be of advantage to the prospective nature photographer, for, as Doctor Cordier's pictures give evidence, the information he now imparts to others he has himself applied with singular success. The author's love for the birds is bound to kindle the reader's sympathetic interest, for it finds expression not merely in an abstention from injury but in repairing injury done, witness his surgical operation upon a white ibis that had broken its leg and that was anaesthetized before the knife was applied.

A NEW POPULAR BOOK ON MINERALS.—One of the most significant tendencies in our present-day life is the urge to get out of doors and learn about the things we see in the woods and on the hillside. A number of popular books have appeared from time to time which have met, or in part have met, this need for non-technical information about the plants, the birds, and the animals. Prof. Frederick Brewster Loomis, of Amherst College, has added to this rapidly increasing book shelf a really practical and very understandable little book on minerals and rocks, entitled *Field Book of Common Rocks and Minerals*, published by G. P. Putnam's Sons.

One of the first requisites of such a field book is that it should be small in compass, and Professor Loomis has succeeded admirably in producing a volume to fit the pocket, and incidentally the pocket-book, of the Boy Scout, which tells him in language that he can understand what he wants to know about the rocks and the minerals that make them. A very attractive feature of the *Field Book* are the many reproductions in color of minerals, which are for the most part admirably executed. The book contains 271

pages, of which 169 are devoted to the minerals and the remainder to the rocks. The minerals are grouped on the basis of their chief metals, bringing together the silver minerals, the lead minerals, and so on.—H. P. W.

WOOD'S "ILLUSTRATED NATURAL HISTORY."—That a volume of systematic zoölogy, issued somewhat less than a decade before the publication of Darwin's *Origin of Species*, should still be read, not flippantly, with the thought of discovering quaint misinformation, but respectfully, for the substantial amount of fact it contains, is rather remarkable. Yet such is the distinction that attaches to the Rev. J. G. Wood's *Illustrated Natural History*, which, first issued in the early fifties of the last century and subsequently expanded into a series of volumes, has recently appeared in a handsome new edition under the imprint of E. P. Dutton and Company. In the preparation of the new edition, which consists of a single volume, there has been necessarily extensive elimination of material, both text and illustrations, but by way of compensation there have been added eight colored plates.

An unfortunate error has resulted through the introduction of division titles in the section on insects. The Neuroptera, already burdened by the inclusion of several groups of insects that have since Wood's day been placed in distinct orders, has by error taken into its fold also the Hymenoptera, which even in Wood's time was a well recognized independent order; while the important order of beetles, like that of the bees, wasps, ants, and sawflies, appears without an introductory heading.

One of the reasons doubtless for the great vitality of Wood's work is the fact that it is presented in so simple and readable a form that it has won its way among circles of readers that are repelled by the heavier language of the technical writer; but its substance too, though necessarily in many details out of date, entitles it to respectful consideration.

HONORARY LIFE MEMBERS OF THE AMERICAN MUSEUM

In the March-April issue of *NATURAL HISTORY* the exploits and achievements of the various expeditions working in different parts of Asia on behalf of the American Museum

will receive emphasis. Honorary life membership has recently been conferred by the Board of Trustees of the Museum upon several individuals who, because of their services in the field or because of their invaluable aid in facilitating the work of exploration, were selected for this distinction. To the reader of the Asiatic number it will be of interest to know in advance something of these individuals, who have contributed so much to the success of the Museum's undertakings in that continent:

COL. J. C. FAUNTHORPE first visited the American Museum in 1919, and was so delighted with the manner in which the mammals were shown in the exhibition halls that he conceived the idea of sending some of the game mammals of India to the American Museum. This initial resolve led step by step to the coöperation of his friend, Mr. Arthur S. Vernay, and to the plans for the Faunthorpe-Vernay Indian Expedition of 1923, which has brought such splendid results to the Museum. An account of this expedition, written by Colonel Faunthorpe, will be one of the notable features of the March-April issue of *NATURAL HISTORY*.

In the intervals of his long service in India Colonel Faunthorpe has become famous as a sportsman, especially through his success in tiger shooting, and many a fine specimen sent to the Museum is a tribute to his marksmanship. In unanimously electing him an honorary life member the Trustees considered his record of service, some of the principal features of which are here briefly indicated:

Subsequent to his graduation from Balliol College, Oxford, he became connected in 1892 with the Indian Civil Service. In 1914, at the call of his country, he joined the Army, having previously served in the United Provinces Horse. He was on duty in France and Belgium until 1918, when he went to America on the War Mission. During 1919 and part of 1920 he was attached to the British Embassy at Washington, D. C. Since 1920 he has been ably administering his office as Commissioner of Lucknow.

MR. ARTHUR S. VERNAY was elected to the rank of honorary life member at the same time as his friend and fellow sportsman, Colonel Faunthorpe. A great lover of sports, Mr. Vernay has traveled widely in search of big game, including in his field trips certain of the wilder parts of North America and various areas of Asia. Mr. Vernay has spread

the knowledge of wild life in Asia through the interviews which he has accorded representatives of the press and through spirited articles descriptive of his remarkable six months' hunt with Colonel Faunthorpe. The splendid qualifications of Mr. Vernay not only as a sportsman but as a naturalist are evidenced in his writings; his article on "Stalking Tsine in Burma," which will appear in the March-April issue of *NATURAL HISTORY*, may be cited as an instance in point. By his own request the expedition in which he was one of the joint leaders is known as the Faunthorpe-Vernay Indian Expedition, but in the case of the photographs and films of the undertaking, the copyright is held in the name of the Vernay-Faunthorpe Expedition to India and Burma. Beautiful examples of the pictures obtained by the expedition have been published in *The Illustrated London News* (August 18, 1923) and *The Illustrated Sporting and Dramatic News* (August 11, 1923 and August 18, 1923) as well as in periodicals in this country.

Mr. Vernay is at present on his way from Moulmain to Bangkok. He has been spending several months in that area, collecting additional specimens for the American Museum.

MR. ROY CHAPMAN ANDREWS.—Seventeen years ago, after graduation from Beloit College, Wisconsin, MR. ANDREWS approached the front of the American Museum as an unknown young naturalist, wondering how he would be received and whether he could find work within its doors. He was fortunate in entering immediately into the service of the venerated curator of mammalogy, Dr. Joel Asaph Allen. Early in his scientific career Mr. Andrews became interested in whales through the acquisition by the Museum of the large whale killed off the Long Island coast at Amagansett, and of the smaller specimen obtained at Wainwright. The two skeletons were collected by Mr. Andrews with the aid of Messrs. James L. Clark and John T. Nichols. During eight years subsequent to this experience Mr. Andrews gave much attention to whales, a group of mammals that will receive emphasis in the proposed hall of ocean life. The work of collecting and studying the cetaceans carried Mr. Andrews "twice around the world, as well as northward on two expeditions to Alaska, and southward to the tropic waters of Borneo and Dutch East Indies." The

last-mentioned places were visited during 1909-10 when Mr. Andrews was cruising in the Far East on the U. S. Fish Commission steamer, *Albatross*. In 1911-12 Mr. Andrews continued his studies in the East by exploring northern Corea, but in 1913 returned to Alaska to secure northern species of whales. The next two years were devoted to working up the whale collections, the year 1914 being signalized also by his marriage to Miss Yvette Borup, sister of Mr. George Borup of Arctic fame. In March, 1916, he organized what has come to be known as the First Asiatic Expedition, and spent nineteen months in conducting it through southern and western China, Fukien, and Yunnan, and thence into western Burma, to proceed down the Irrawaddy River from Bhamo to Rangoon. In 1919, Mr. Andrews headed the Second Asiatic Expedition to northern China and outer Mongolia, and this undertaking led in turn to the highly successful Third Asiatic Expedition, with the progress of which readers of *NATURAL HISTORY* are familiar through articles contributed by Professor Osborn and Mr. Andrews and through numerous Notes. Mr. Andrews is the author of a number of works dealing with his field experiences and scientific studies. Among these are: *The California Gray Whale*, *The Sei Whale*, *Whale Hunting with Gun and Camera*, *Camps and Trails in China*, and *Across Mongolian Plains*.

HIS EXCELLENCY THE EARL OF READING, G.C.B., VICEROY OF INDIA is too well known for his statesmanship and the potent rôle he has played in the political life of the British Empire to require an introduction to our readers. As president of the Anglo-French Loan Mission to the United States in 1915, as special envoy in 1917, and finally as high commissioner and special ambassador to our country in 1918, he is especially well remembered, although these offices were but a few of the posts of responsibility that he has held in the course of his eventful career. As viceroy and governor-general of India he gave the Faunthorpe-Vernay Expedition invaluable support, and the tiger group is to be presented to the American Museum in his name as a constant reminder to the public of his part in making the expedition a success.

HIS EXCELLENCY SIR HARCOURT BUTLER, G.C.I.E., is governor of Burma, and the practical assistance which he gave to the Faunthorpe-Vernay Expedition will be com-

memorated through the association of his name with the specimens obtained in Burma. It was he who gave the expedition his sanction to shoot any animals necessary to the collection and who deputed Mr. D. F. Hopwood, M.C., to arrange all the bandobust. He showed the greatest interest in the work generally and his helpfulness has extended to the expedition of Mr. Vernay that is now in progress, to which he has given every encouragement and support.

TO GENERAL HIS HIGHNESS MAHARAJA SIR CHANDRA SHUMSHERE JUNG, prime minister and marshall of Nepal, the Faunthorpe-Vernay Expedition is under special obligations for the invaluable assistance he gave in the collecting of the rhinoceros specimens. In India the rhinoceros is royal game and the privilege to hunt it is one of the most difficult to obtain. The Maharaja not only accorded this permission but with regal generosity supplied the expedition with Nepalese officials, coolies, elephants, and food supplies, indispensable to the carrying out of the project. The group of the great one-horned rhinoceros will, with the Maharaja's permission, be presented in his name.

MR. A. P. KINLOCH, a coffee planter of India, has been of great aid to the Faunthorpe-Vernay Indian Expedition, to the collected fauna of which he contributed certain rare birds that he obtained in the Kollengode Division. Mr. Kinloch is a keen ornithologist and the fact that the material he collected was accompanied by field notes adds to its value. He is particularly interested in the avifauna of the Nelliampathy Hills, to the literature of which he has been a contributor.

MR. FRANZ A. LARSEN went to Mongolia as a missionary more than thirty years ago. The country and its people appealed to him so greatly that he decided to make his home there. Mr. Larsen eventually gave up his missionary work and entered business, becoming manager of the Anderson and Meyer Company. He organized a branch office in Urga and carried on the work of the company successfully under the most disadvantageous conditions. Leaving the employ of the company in 1922, he organized the firm of F. A. Larsen and Company for the export of furs, ponies, and other Mongolian products. During Mr. Larsen's long residence in Mongolia he has taken part in almost every political event of importance in that country. He has enjoyed

the entire confidence of the Mongolian government and has acted as an intermediary in settling many political questions between the Mongols and Chinese. In 1922, Mr. Larsen accompanied the Third Asiatic Expedition for a part of the time it sojourned in Mongolia, and it was largely through his active work on behalf of the expedition that permission to carry on its investigations was granted by the Mongolian government.

MR. C. BADMAJAPOFF, who is Mongolian minister of justice, accompanied the famous Russian explorer, Colonel Kozloff, on a three-year tour of exploration in Mongolia and Tibet. He was a member of the Third Asiatic Expedition during part of the summer of 1922. Occupying an important position in the Mongolian government, he assisted the members of the expedition very greatly by obtaining permission for them to work in Mongolia both during the seasons of 1922 and 1923.

Since the last issue of *NATURAL HISTORY* the following persons have been elected members of the American Museum, making the total membership 7260:

Patron: MR. ARTHUR S. VERNAY.

Honorary Life Members: MRS. MARY WHITE TSIPOURAS; GENERAL HIS HIGHNESS MAHARAJA SIR CHANDRA SHUMSHERE JUNG; HIS EXCELLENCY THE EARL OF READING, G.C.B. and HIS EXCELLENCY SIR HARCOURT BUTLER, G.C.I.E.; DR. JOSEPH BEQUAERT; MESSRS. ROY CHAPMAN ANDREWS, C. BADMAJAPOFF, A. P. KINLOCH, and FRANZ A. LARSEN.

Life Members: PROF. ALICE WILSON WILCOX; MESDAMES GEORGE TEMPLE BOWDOIN, E. L. DICKERSON, GEORGE F. KUNZ, CARSON C. PECK, F. SULLIVAN SMITH; DR. HENRY H. COVELL; MESSRS. BEECHER S. BOWDISH, GEORGE T. BROKAW, WALTER W. HOLMES, MASON M. PHELPS, and ALBERT T. STEWART.

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